FCC Test Report

Report No.:	FCC_RF_SL20031101-SPC-001 Rev_5.0
FCC ID:	OJFRN510
Test Model:	SCRN-510-28G1
Received Date:	09/14/2020
Test Date:	09/28/2020 ~ 11/02/2020
Issued Date:	11/03/2020
Applicant:	Corning Optical Communication
Address:	475 Sycamore Dr, Milpitas, CA 95035, U.S.A.
Manufacturer:	Corning Optical Communication
Address:	475 Sycamore Dr, Milpitas, CA 95035, U.S.A.
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035, USA
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035, USA
FCC Registration / Designation Number:	540430/4842D

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
FCC_RF_SL20031101-SPC-001	Orignal Release	10/15/2020
FCC_RF_SL20031101-SPC-001 Rev_1.0	Update Per Review	10/22/2020
FCC_RF_SL20031101-SPC-001 Rev_2.0	Update Per Review	10/26/2020
FCC_RF_SL20031101-SPC-001 Rev_3.0	Update Per Review	10/26/2020
FCC_RF_SL20031101-SPC-001 Rev_4.0	Update Per Review	11/03/2020
FCC_RF_SL20031101-SPC-001 Rev_5.0	Update Device Class Designation	11/03/2020

1 Certificate of Conformity

Product:	5G mmWave SmallCell Radio Node
Brand:	COC Wireless
Test Model:	SCRN-510-28G1
Sample Status:	Engineering sample
Applicant:	Corning Optical Communication
Test Date:	09/28/2020 ~ 11/02/2020
Standards:	47 CFR FCC Part 2 47 CFR FCC Part 30 ANSI C63.26:2015

The above equipment has been tested by **Bureau Veritas Consumer Products Services Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** 11/03/2020

Deon Dai / Test Engineer

Approved by : _____ , **Date:** 11/03/2020

Shuo Zhang / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 30			
FCC Clause	Test Item	Result	Remarks
2.1047	Modulation characteristics	PASS	Meet the requirement
30.202	EIRP	PASS	Meet the requirement of limit.
2.1049	Occupied Bandwidth	PASS	Meet the requirement of limit.
2.1053 30.203	Radiated Spurious Emissions	PASS	Meet the requirement of limit.
2.1053 30.203	Out-of-Band Emission at the Band Edge	PASS	Meet the requirement of limit.
2.1055	Frequency Stability	PASS	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	5G mmWave SmallCell Radio Node
Brand	COC Wireless
Test Model	SCRN-510-28G1
Identification No. of EUT	3037200009
Status of EUT	Engineering sample
Power Supply Rating	48 Vdc from adapter
Modulation Type	QPSK, 64QAM
Operating Frequency	n261:27.5 GHz ~ 28.35 GHz
Supported Channel Bandwidth	100MHz, 400MHz
Supported Component Carriers	1CC, 4CC
Max. E.I.R.P. Power (RMS)	42.66 dBm
Antenna Type	Patch Array
Antenna Information	The QTM10028 antenna module is an active patch phased array operating at 5G FR2 band. It is designed with 64 patch elements, where each element has dual polarization operation (vertical & horizontal). This antenna module highly integrates power amplifier and phase shifter. By adjusting amplitude and phase independently for each element, the QTM10028 antenna module can provide good beamforming performance for actual application.

Note:

1. The EUT uses following adapter.

Brand	MEAN WELL Technology
Model	GST120A48
Input Power	100-240VAC, 50/60Hz, 1.4A
Output Power	48V, 2.5A, 120W

2. The EUT contains one module for millimeter wave.

Millimeter wave module	
Radio Module	Status
QCA mmWave (QTM10028)	Active

3. The worst Beam ID:

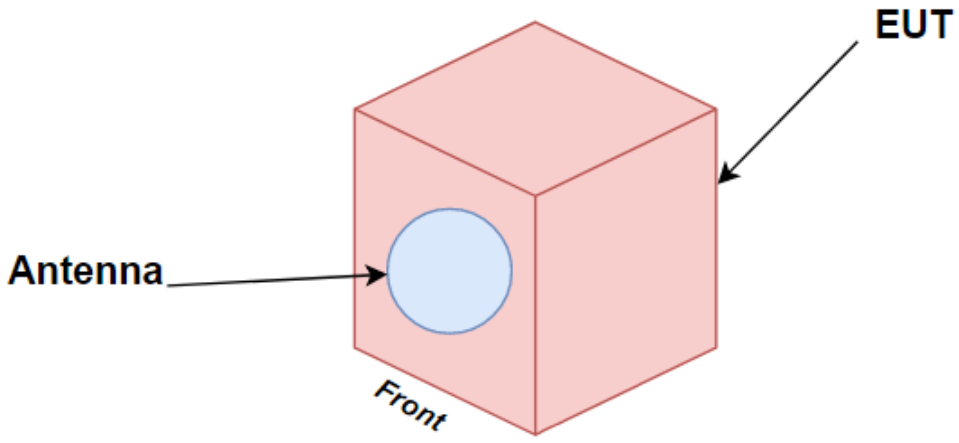
Beam ID		
Single Beam		MIMO Beam
11	139	11 + 139

4. The following antenna was provided to the EUT:

Ant. No.	Freq. range (MHz)	Ant. Type	Ant. Gain (dBi)	Connector Type
5G NR Antenna	27500~28350	Patch Array	22.5	N/A

5. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.
6. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

7. Antenna Location



3.2 Description of Test Modes

Band	Channel Bandwidth (MHz)	Channel	Beam ID
n261	100, 400	Low	Single Beam: 11, 139 MIMO Beam: 11 + 139
		Middle	
		High	

3.2.1 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.
The worst case was found when positioned on Z-plane. Following channel(s) was (were) selected for the final
test as listed below:

Test Item	Modulation	Test Carriers	Test Channel	Beam ID
Modulation characteristics	QPSK, 64QAM	1CC	H	Single Beam: 139
EIRP	QPSK, 64QAM	1CC, 4CC	L, M, H	Single Beam: 11, 139 MIMO Beam: 11 + 139
Occupied Bandwidth	QPSK, 64QAM	1CC, 4CC	L, M, H	Single Beam: 11, 139
Radiated Spurious Emissions	QPSK	1CC	L, M, H	Single Beam: 11, 139 MIMO Beam: 11 + 139
Out-of-Band Emission at the Band Edge	QPSK	1CC, 4CC	L, H	Single Beam: 11, 139 MIMO Beam: 11 + 139
Frequency Stability	QPSK, 64QAM	1CC	M	Single Beam: 139

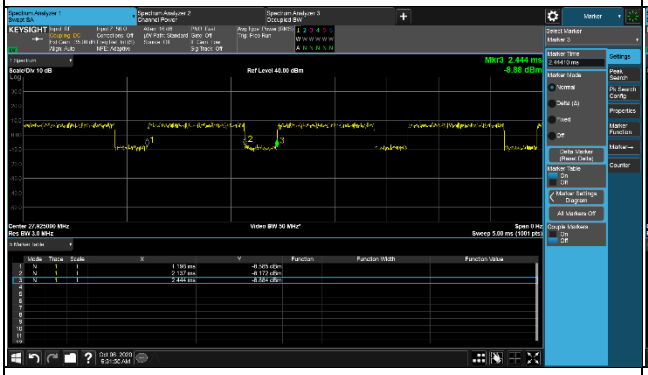
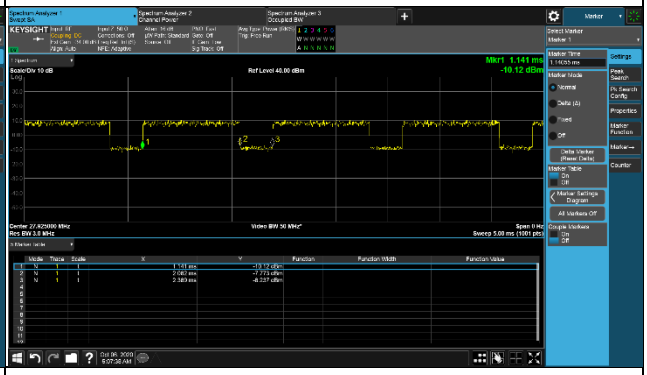
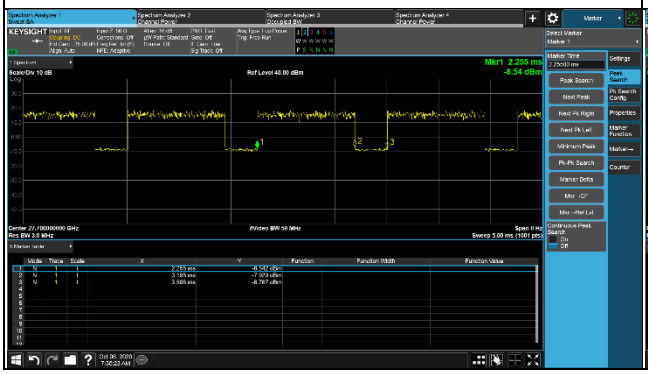
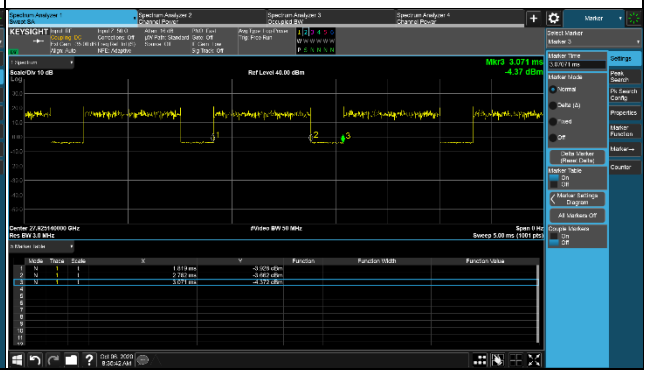
Note:
1. All test results have been considered correction factor for more detail values please refer to “Annex A”.
2. All supported modulation types were evaluated. The worst case was found in QPSK modulation for all final tests.
3. This device was tested under all RB configs/offsets. The worst case was found in full RB config/offset for all final tests.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Modulation characteristics	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai
EIRP	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai
Occupied Bandwidth	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai
Radiated Spurious Emissions	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai
Out-of-Band Emission at the Band Edge	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai
Frequency Stability	22deg. C, 70%RH	120Vac, 60Hz	Deon Dai

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %.

Band / n261	
QPSK-1CC	64QAM-1CC
	
QPSK-4CC	64QAM-4CC
	

3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	10 Gigabit SFP+ Switch	MikroTik	CRS305-1G-4S+IN	B9E90C3D65FE/015	N/A	Used to allow EUT and laptop communication via fiber optic and Ethernet connections.
B.	Laptop	Dell	P19F	KPM28 A00	N/A	Used to configure the test setup. Connects to item B below to allow communication between the laptop and EUT.
C.	AC/DC power adapter	Meanwell	GST120A48	EB9BG07450	N/A	Used to power the EUT.

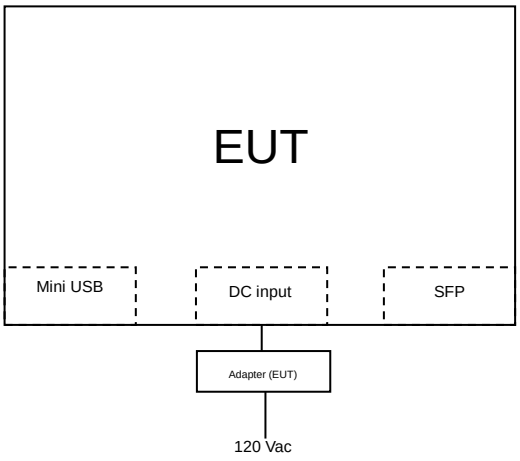
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items E~F acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Fiber optic cable	1	10	No	0	Used to terminate the SFP port on the EUT.
2.	RJ45 Ethernet cable	1	0.9	No	0	Used to connect the laptop to the 10 Gigabit SFP+ Switch which allows the laptop to communicate with the EUT and send it commands.

Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 30

ANSI 63.26-2015

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 662911 D02 MIMO with Cross Polarized Antenna v01

KDB 842590 D01 Upper Microwave Flexible Use Service v01r01

All test items have been performed as a reference to the above KDB test guidance

4 Test Types and Results

4.1 Modulation characteristics

4.1.1 Limits of Modulation characteristics

N/A

4.1.2 Test Results

Band / n261	
QPSK-1CC / High Channel	64QAM-1CC / High Channel
	

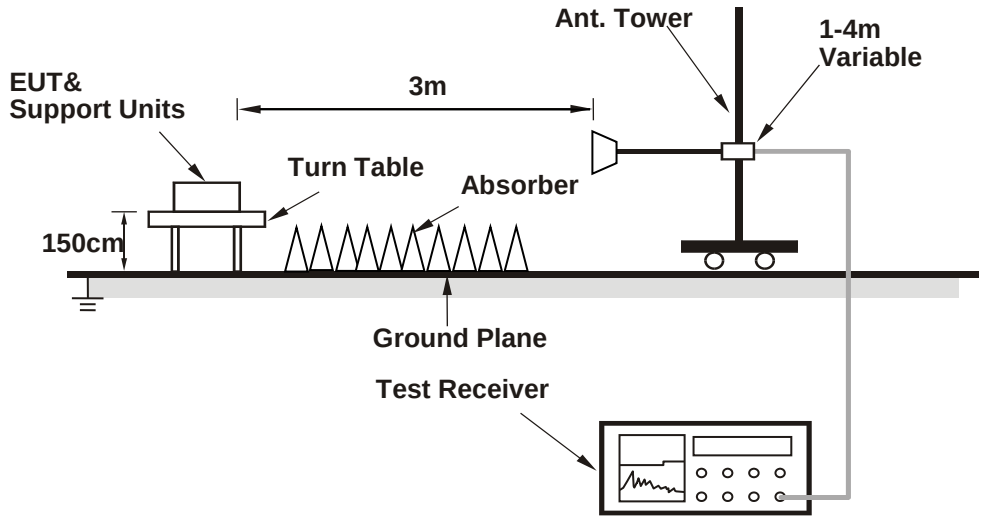
4.2 Equivalent Isotropic Radiated Power (EIRP) Density Measurement

4.2.1 Limits of EIRP Density Measurement

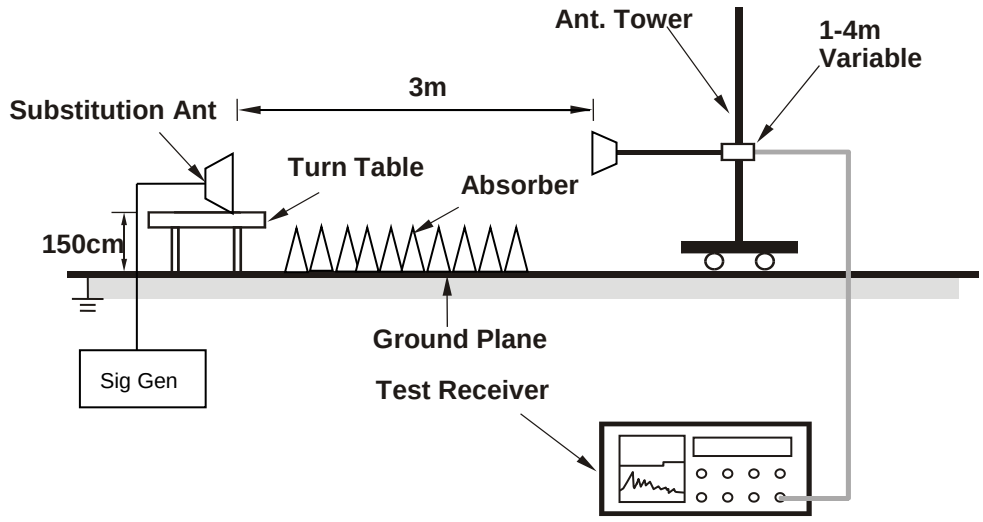
Device	Maximum Limit of EIRP
Fixed and base stations	EIRP 75dBm/100MHz (sum of all antenna elements)

4.2.2 Test Setup

Test set-up for radiated ERP and/or EIRP measurements



Path loss measurement set-up



4.2.3 Test Instruments

For Below 40GHz and Frequency Stabillity:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Receiver Rohde & Schwarz	ESW 44	100179	08/30/2019	08/30/2020
Biconilog Antenna Sunol	JB1	A030702	03/09/2020	03/09/2021
Horn Antenna ETS-Lindgren	3117	218554	12/20/2019	12/20/2020
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	06/18/2019	06/18/2020
Spectrum Analyzer Keysight	N9030B	MY57140597	06/15/2020	06/15/2021
DRG Horn Antenna A.H. System, Inc	SAS-574	579	05/08/2020	05/08/2022
Signal Generator Keysight	E8257D	MY27280548	11/02/2019	11/02/2020
Tuned Dipole Antenna 30 - 1000 MHz (4pcs set)	AD-100	40133	08/24/2020	08/24/2022

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NIST/USA.

For Above 40GHz:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
OXE89 Horn Antenna (33~55GHz) QuinStar	QWH-UCRR00	924200002	01/20/2020	01/19/2022
Conical Horn Antenna (50~75GHz) Keysight	WR15CH-Conical	WR15CH_001	01/20/2020	01/19/2022
Conical Horn Antenna (75~110GHz) Keysight	WR10CH-Conical	WR10CH_001	01/20/2020	01/19/2022
VDI Standard Downconverter (50-75 GHz) Keysight	N9029AV15	SAX012	CoC	CoC
VDI Standard Downconverter (75-110 GHz) Keysight	N9029AV10	SAX013	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (50~75 GHz) Keysight	E8257DV15	SGX007	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	SGX004	CoC	CoC
Spectrum Analyzer Keysight	N9030B	MY57140597	06/15/2020	06/15/2021
Signal Generator Keysight	E8257D	MY27280548	11/02/2019	11/02/2020

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NIST/USA.

2. COC: Certificate of conformance

4.2.4 Test Procedures

EIRP Measurement

a. Using Annex B.3 of ANSI 63.26 test procedure to measure the path loss.

b. Using pre-test site path loss to determine EUT emission power.

c. EUT emission powers are calculated using the following equation.

Emission Power = EUT Prec [dBm EIRP] + P_L [dB]

Where

EUT Prec is the power of the emission measured at the test receiver during EUT measurements

PL is the path loss determined on the frequency of the EUT emission or calculated using linear interpolation between site characterization frequencies

d. The PL (including cable and measurement antenna factors) are using the worst value into calculated and
offset to the spectrum analyzer during the testing.

NOTE: Measurements were taken in the far field of the mm-Wave test signal based on the formula:
R ≥ (2D^2) / wavelength.

EUT antenna of far field distance		
Measureent Frequency range	Far Field calculation distance	Measurement Distance (Far field)
Below 18GHz	0.4135m	3m
18GHz to 40GHz	0.9189m 2m	2m
40GHz to 50GHz	0.9189m to 1.1486m	2m
50GHz to 100GHz	1.1486m to 2.2971m	3m
Note: EUT Antenna Dimension 42mm length, 41mm thick.		
Measurement antenna of far field distance		
Measureent Frequency range	Far Field calculation distance	Measurement Distance (Far field)
18GHz-40GHz	0.75m to 1.66	2m
40GHz-50GHz	0.20m to 0.33m	2m
50GHz-75GHz	0.21m to 0.31m	3m
75GHz-110GHz	0.16m to 0.24m	3m
18GHz-40GHz: Antenna Dimension 79mm length.		
40GHz-50GHz: Antenna diameter 30mm length.		
50GHz-75GHz: Antenna diameter 25mm length.		
75GHz-100GHz: Antenna diameter 18mm length.		

NOTE:

Test Instruments for above 18 GHz emission test

1. 18 GHz - 40 GHz: HORN Antenna (SAS-574) + Pre-Ammlifier (RAMP00M50GA)
2. 40 GHz - 50 GHz: HORN Antenna (QWH-UCRR00) + Ammlifier (RAMP00M50GA)
3. 50 GHz - 75 GHz: HORN Antenna (WR15CH-Conical) + VDI Standard Downconverter
4. 75 GHz - 100 GHz: HORN Antenna (WR10CH-Conical) + VDI Standard Downconverter

The emission test results as above listed are performed by different frequency bands respectively because the test instruments, that will make the emission trace non-continuously for these bands.

Conducted Power Measurement

a. Using section 4.4.2.5 of the KDB 842590 D01 test procedure.
b. Conducted Power level (dBm) at any frequency/BW = Measured EIRP level (dBm)/BW – EUT antenna Gain (dBi)

4.2.5 Test Settings

a. Radiated power measurements were performed using the spectrum analyzer's channel power measurement function.
b. Set the RBW =1~5% of the anticipated RBW=1MHz, and the VBW ≥ 3 x RBW.
c. Set spectrum analyzer detection mode to RMS
d. Span = 2x to 3x the OBW
e. No. of sweep points ≥ 2 x span / RBW
f. Trigger is set to "free run" for test signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less that or equal to the transmission burst duration.
g. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signal with burst transmission, the "gating" function was enabled to ensure that measurements were performed during times in which the transmitter is operating at its maximum power.
h. Trace mode = trace averaging (RMS) over 100 sweeps.
i. The trace was allowed to stabilize.
j. For MIMO parameter:
The e.i.r.p of the H Beam and V Beam were first measured individually. The measured values were then
summed in linear power units then converted back to dBm per the guidance of KDB 662911 D01 and D02.
MIMO e.i.r.p. = e.i.r.p.H + e.i.r.p.V

4.2.6 Deviation fromTest Standard

No deviation.

4.2.7 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.8 Test Results

Band	n261	Beam ID	11
EUT position	Z-plane	Receive Antenna polarization	Vertical

QPSK-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2071666	27550	39.21	75
2077916	27925	39.76	75
2084166	28300	39.37	75

64QAM-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2071666	27550	37.76	75
2077916	27925	39.70	75
2084166	28300	39.45	75

QPSK-4CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2074166	27700.02	39.63	75
2077918	27925.14	39.58	75
2081666	28150.02	39.63	75

64QAM-4CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2074166	27700.02	39.57	75
2077918	27925.14	39.68	75
2081666	28150.02	39.59	75

Remarks:
1. The EIRP was evaluated on vertical and horizontal polarization.

Band	n261	Beam ID	139
EUT position	Z-plane	Receive Antenna polarization	Horizontal

QPSK-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2071666	27550	38.66	75
2077916	27925	39.30	75
2084166	28300	39.48	75

64QAM-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2071666	27550	38.65	75
2077916	27925	39.25	75
2084166	28300	39.57	75

QPSK-4CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2074166	27700.02	39.42	75
2077918	27925.14	39.69	75
2081666	28150.02	39.67	75

64QAM-4CC

Channel No.	Freq. (MHz)	EIRP (dBm)	Limit (dBm/100MHz)
2074166	27700.02	39.40	75
2077918	27925.14	39.50	75
2081666	28150.02	39.48	75

Remarks:
1. The EIRP was evaluated on vertical and horizontal polarization.

Band	n261	Beam ID	11 + 139
EUT position	Z-plane	Receive Antenna polarization	Vertical + Horizontal

QPSK-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)			Limit (dBm/100MHz)
		Beam ID		MIMO Beam	
		11	139	11 + 139	
2071666	27550	39.21	38.66	41.95	75
2077916	27925	39.76	39.30	42.55	75
2084166	28300	39.37	39.48	42.44	75

64QAM-1CC

Channel No.	Freq. (MHz)	EIRP (dBm)			Limit (dBm/100MHz)
		Beam ID		MIMO Beam	
		11	139	11 + 139	
2071666	27550	37.76	38.65	41.24	75
2077916	27925	39.70	39.25	42.49	75
2084166	28300	39.45	39.57	42.52	75

QPSK-4CC

Channel	Channel No.	Freq. (MHz)	EIRP (dBm)			Limit (dBm/100MHz)
			Worst Beam ID		MIMO Beam	
			11	139	11 + 139	
Low	2071667	27550.08	33.72	32.66	36.23	75
	2073333	27650.04	33.15	32.98	36.08	75
	2074999	27750.00	32.47	32.03	35.27	75
	2076665	27849.96	33.32	33.17	36.26	75
Mid	2075419	27775.20	31.44	32.21	34.85	75
	2077085	27875.16	32.78	32.67	35.74	75
	2078751	27975.12	33.21	32.69	35.97	75
	2080417	28075.08	33.67	33.55	36.62	75
High	2079167	28000.08	32.66	32.26	35.47	75
	2080833	28100.04	33.17	32.64	35.92	75
	2082499	28200.00	33.78	33.14	36.48	75
	2084165	28299.96	33.49	33.72	36.62	75

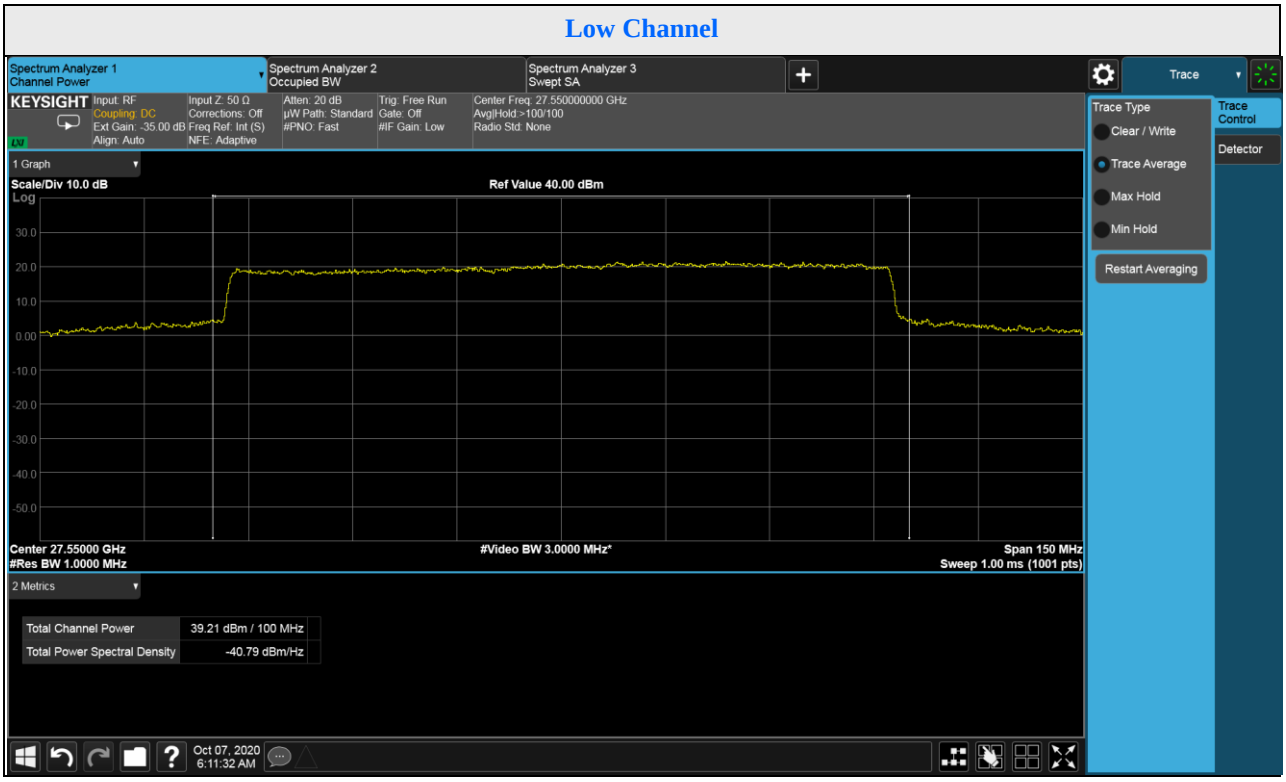
64QAM-4CC

Channel	Channel No.	Freq. (MHz)	EIRP (dBm)			Limit (dBm/100MHz)
			Worst Beam ID		MIMO Beam	
			11	139	11 + 139	
Low	2071667	27550.08	32.83	33.38	36.12	75
	2073333	27650.04	32.90	33.46	36.20	75
	2074999	27750.00	32.15	32.32	35.25	75
	2076665	27849.96	33.55	33.61	36.59	75
Mid	2075419	27775.20	31.27	32.20	34.77	75
	2077085	27875.16	32.44	32.61	35.54	75
	2078751	27975.12	33.20	33.13	36.18	75
	2080417	28075.08	33.66	33.45	36.57	75
High	2079167	28000.08	32.68	32.71	35.71	75
	2080833	28100.04	33.12	33.03	36.09	75
	2082499	28200.00	33.65	33.06	36.38	75
	2084165	28299.96	33.22	33.98	36.63	75

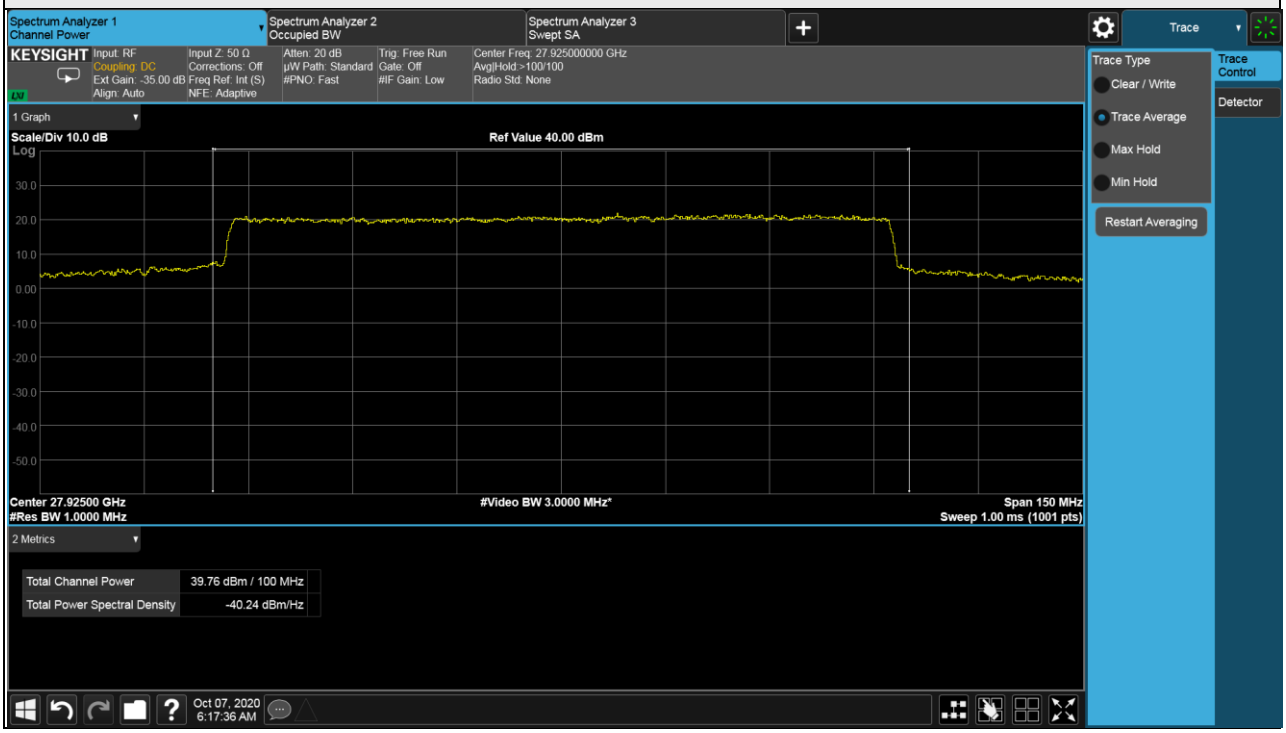
QPSK-1CC (Worse case plots)

Beam ID: 11

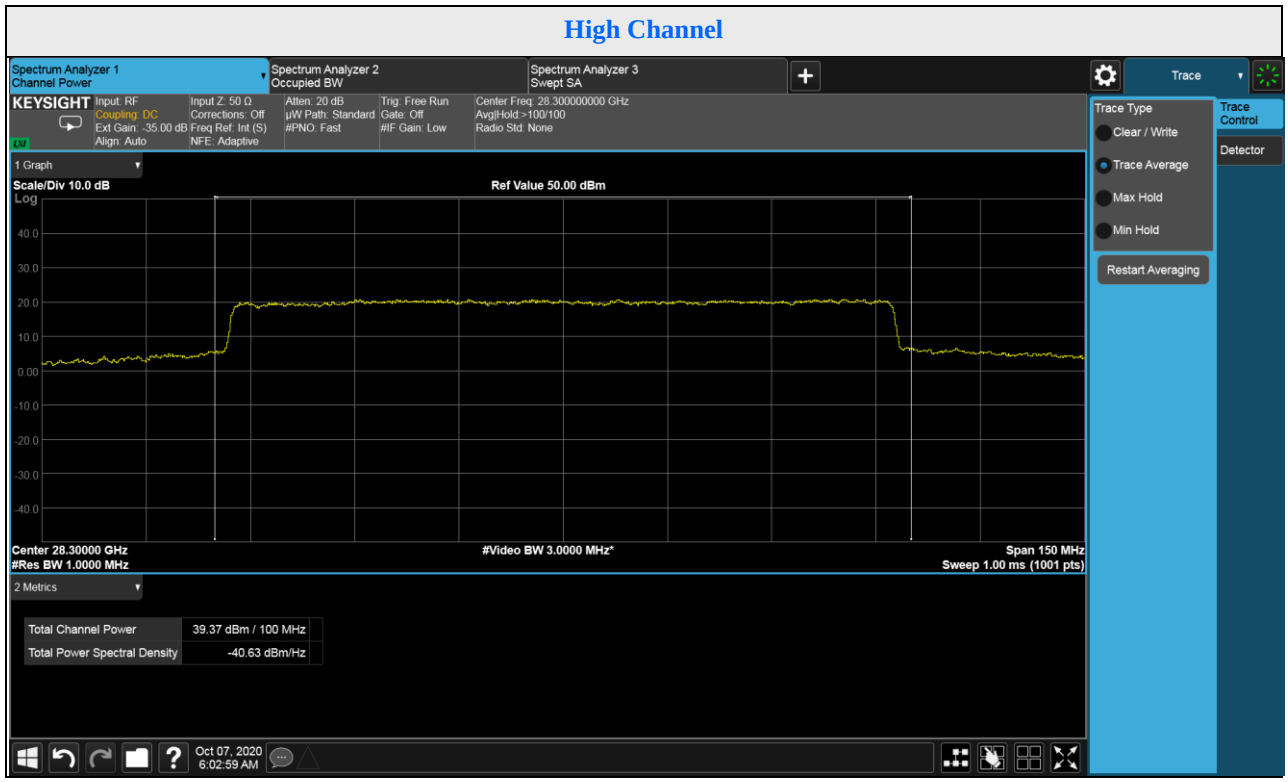
Low Channel



Middle Channel



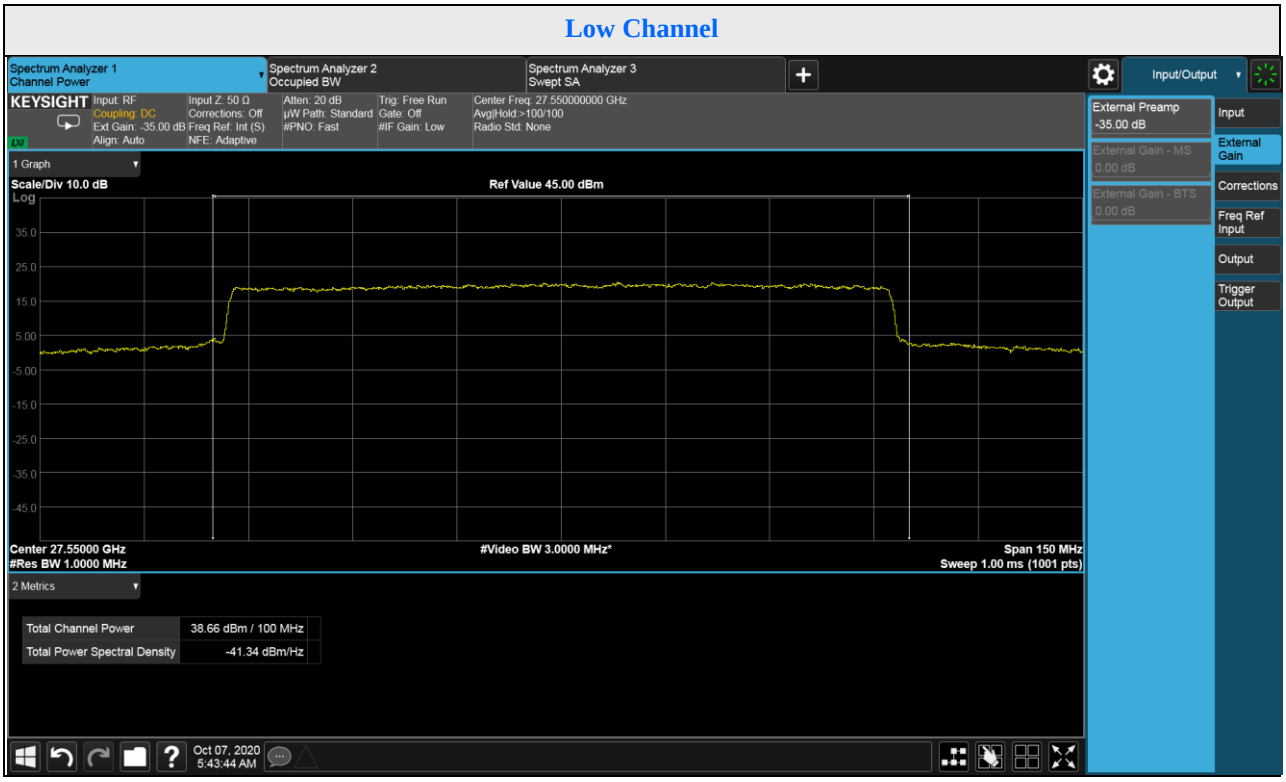
High Channel



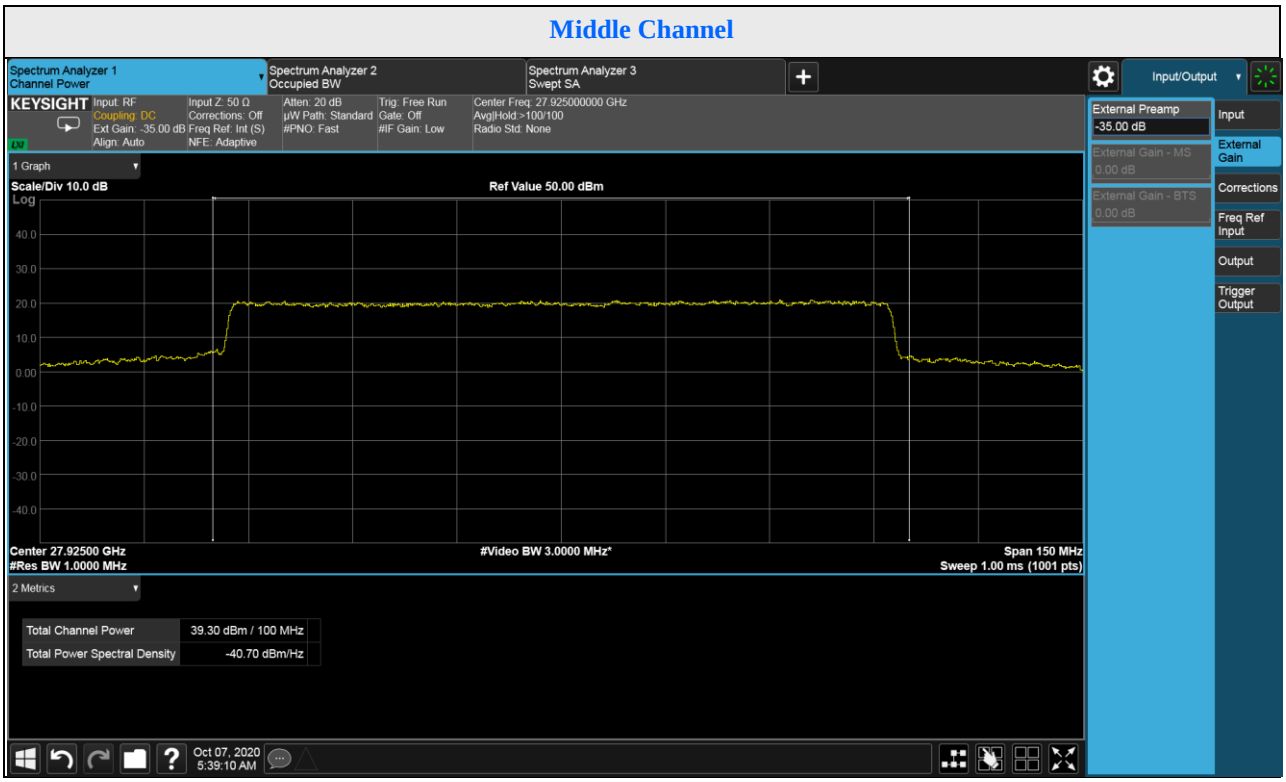
QPSK-1CC(Worse case plots)

Beam ID: 139

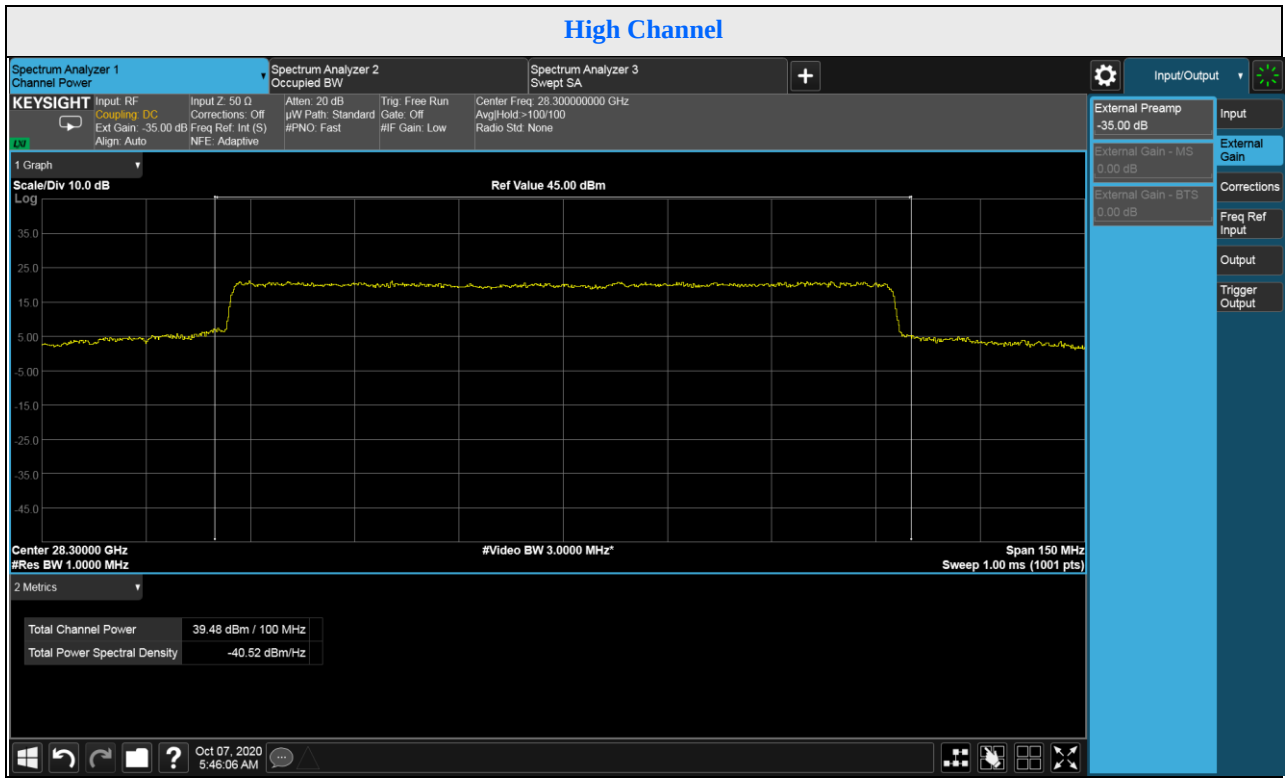
Low Channel



Middle Channel



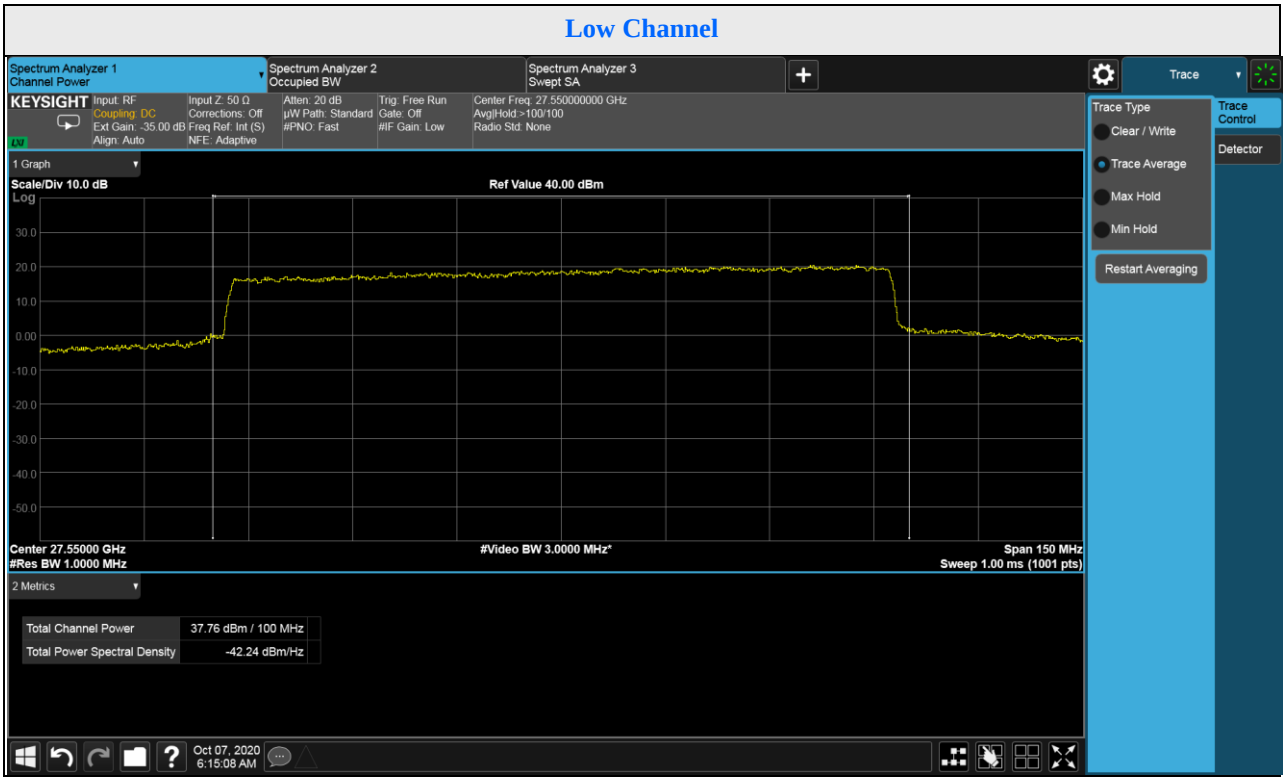
High Channel



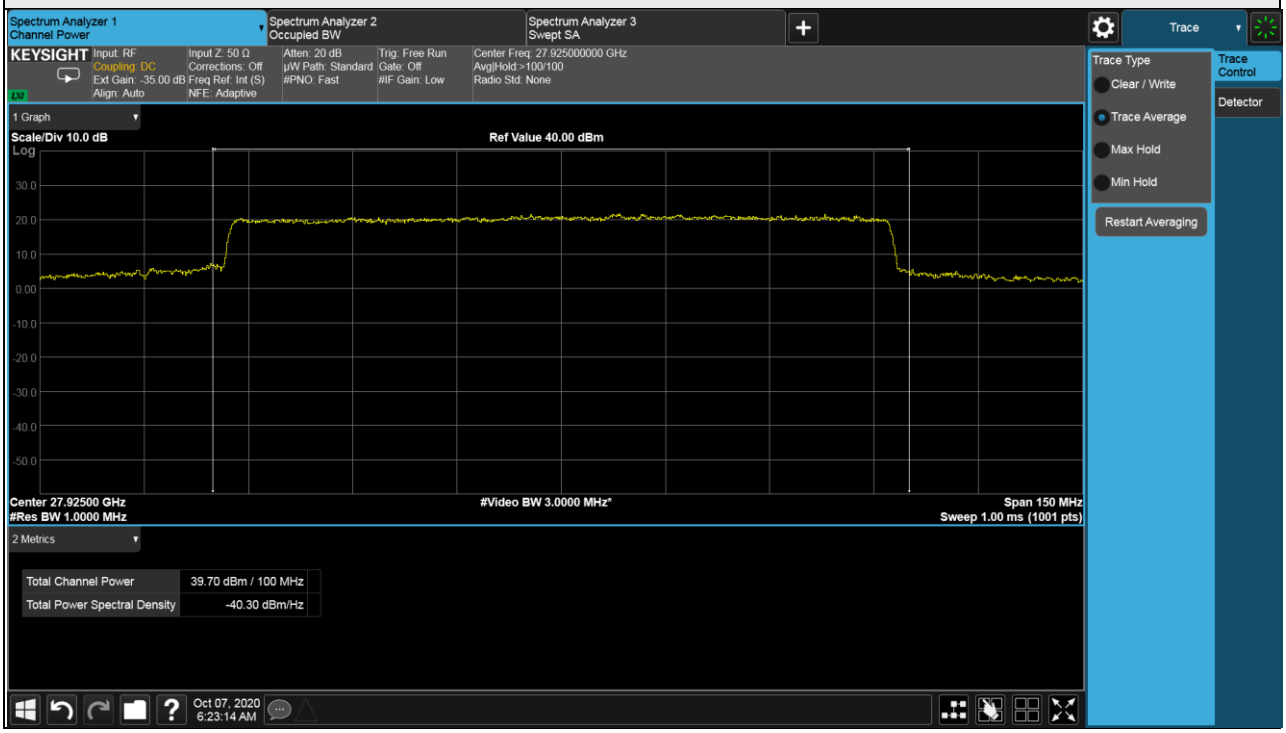
64QAM-1CC(Worse case plots)

Beam ID: 11

Low Channel



Middle Channel



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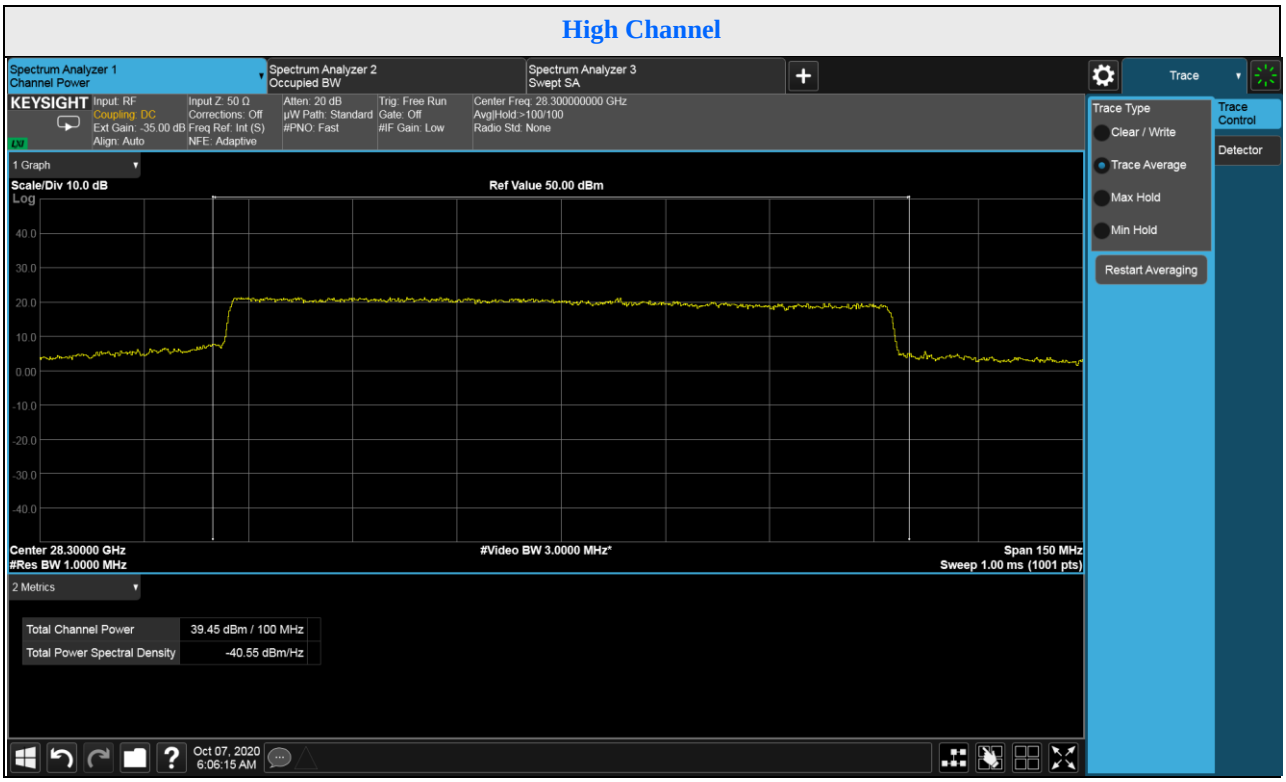

64QAM-1CC (Worse case plots)

Beam ID: 139

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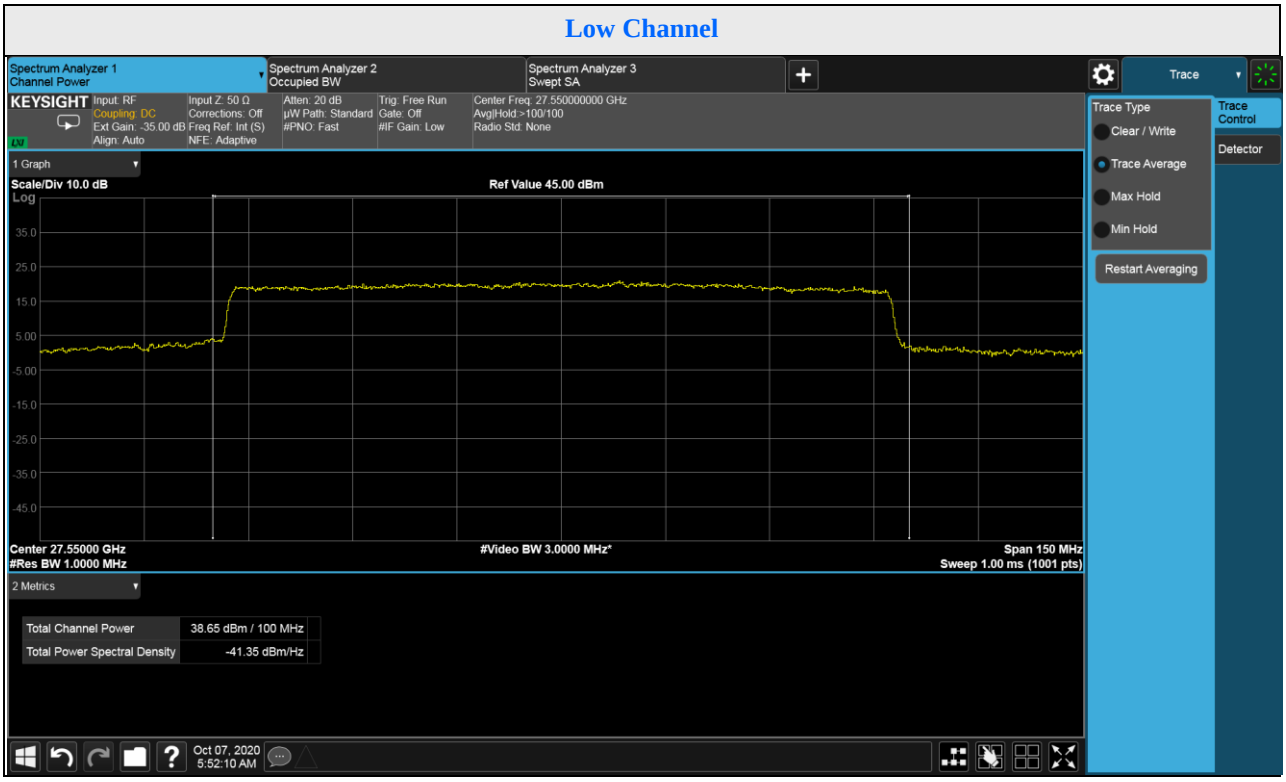

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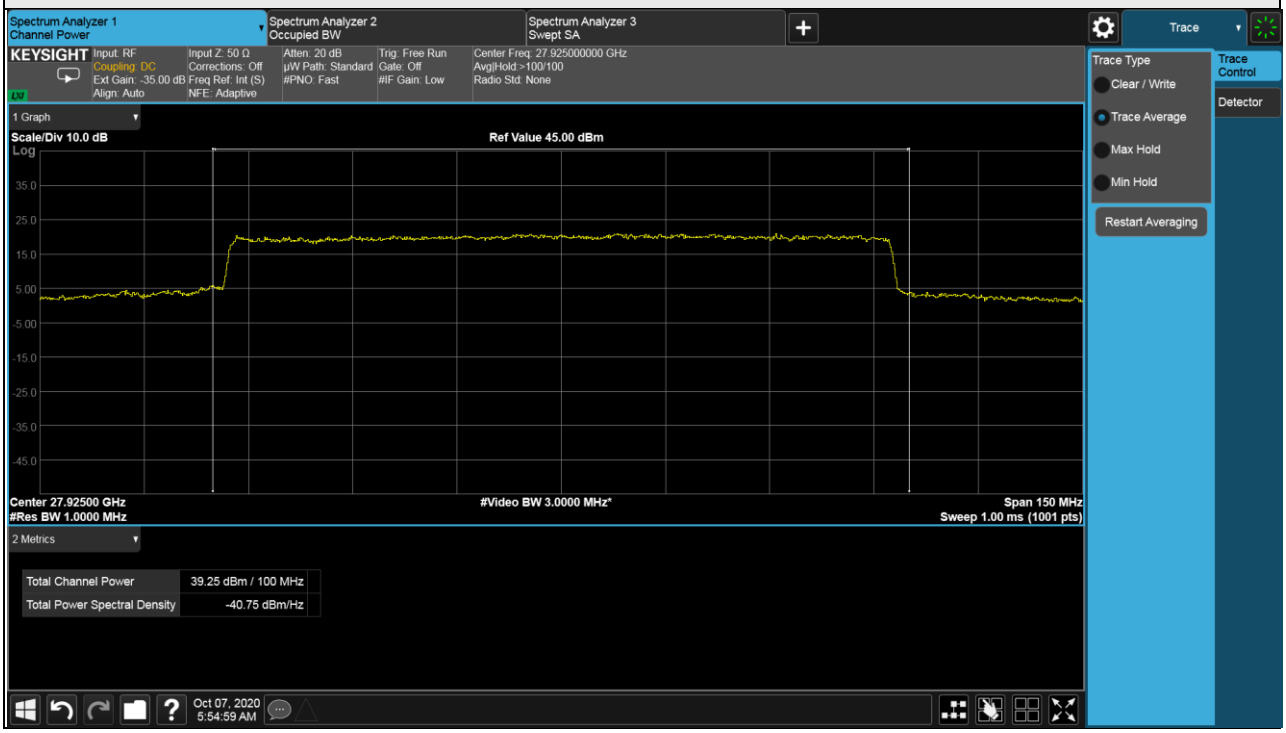

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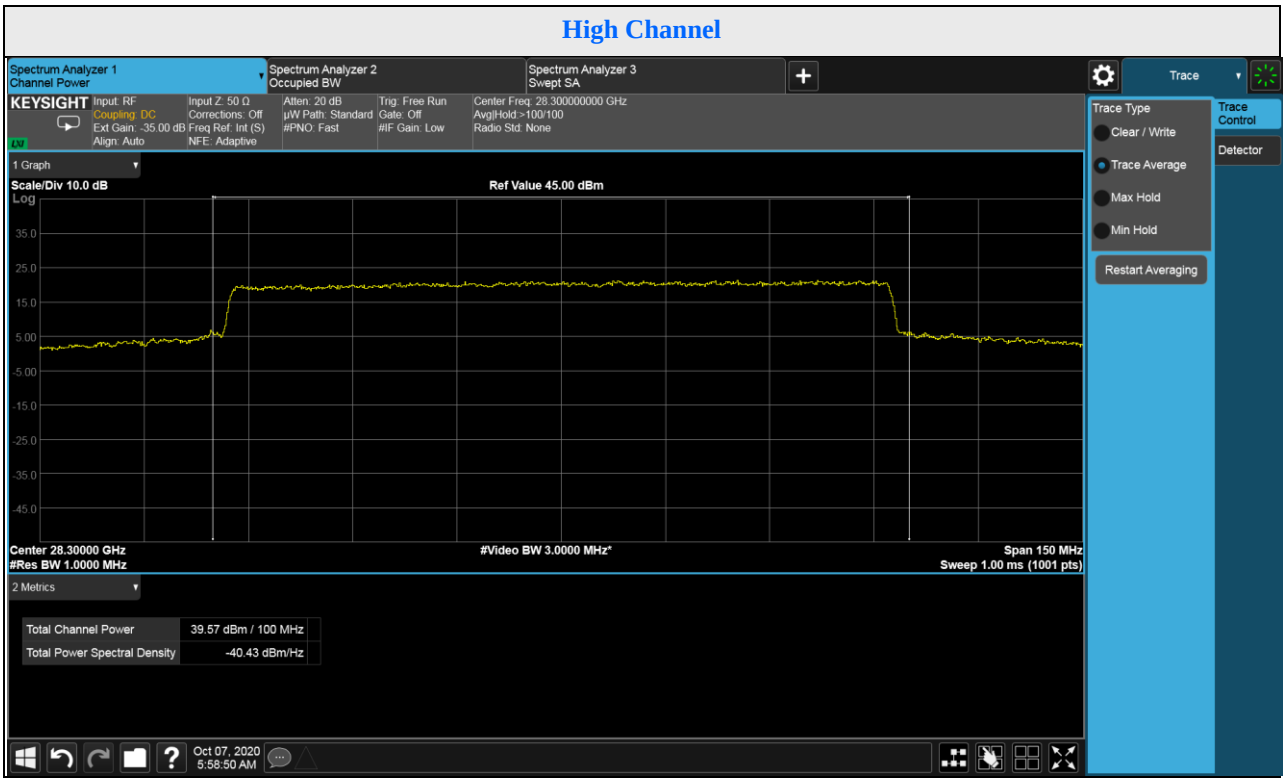

QPSK-4CC

Beam ID: 11

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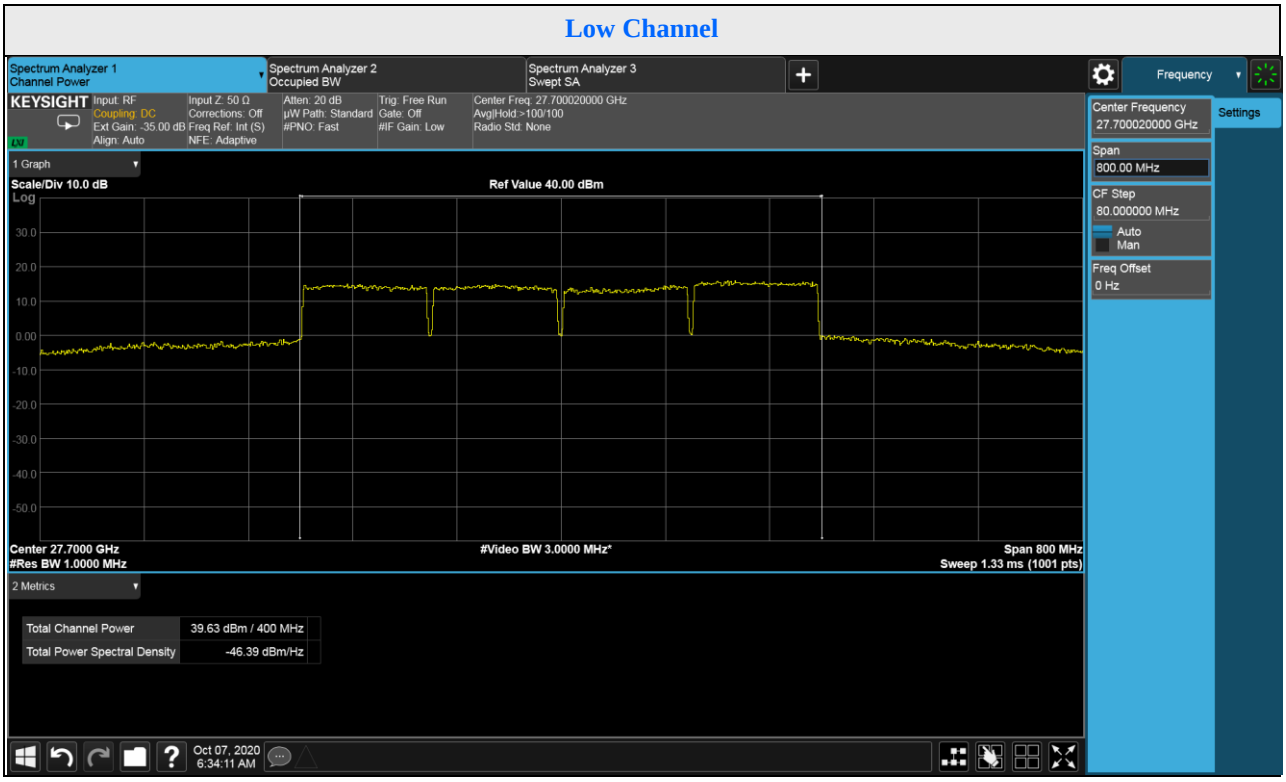
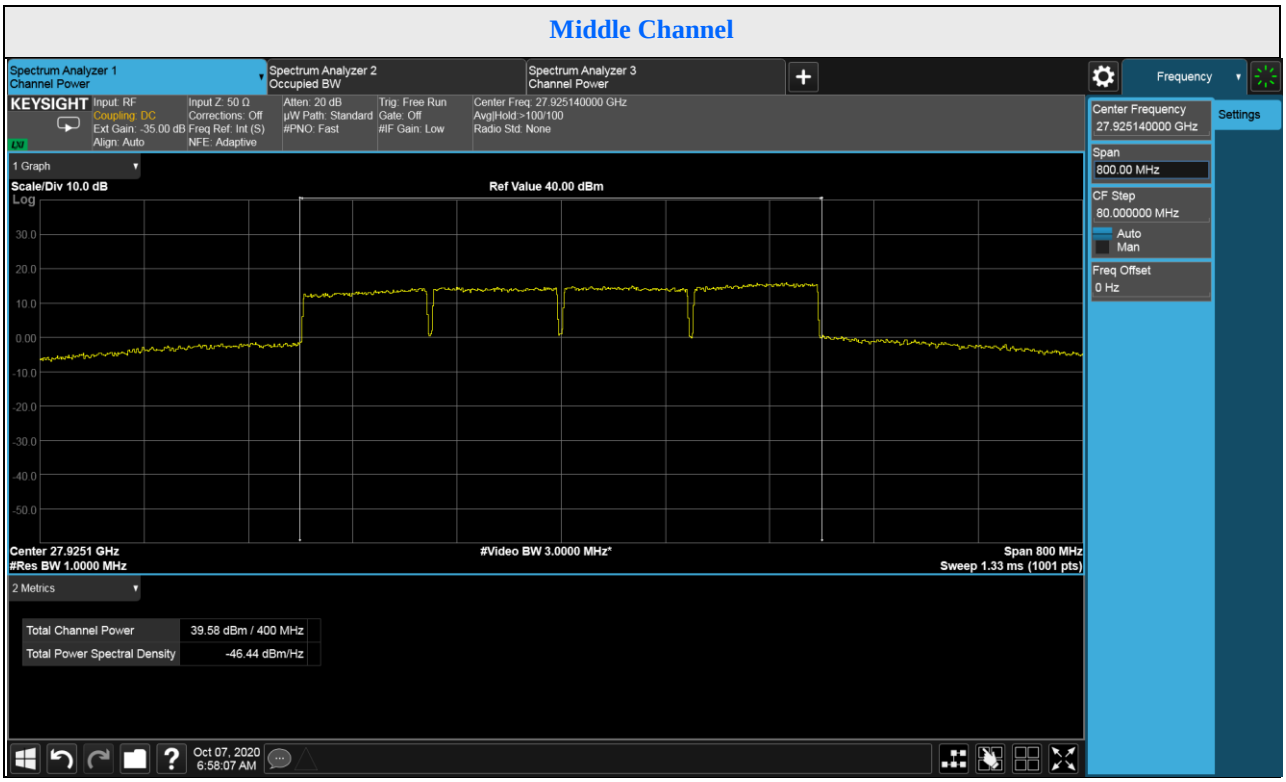
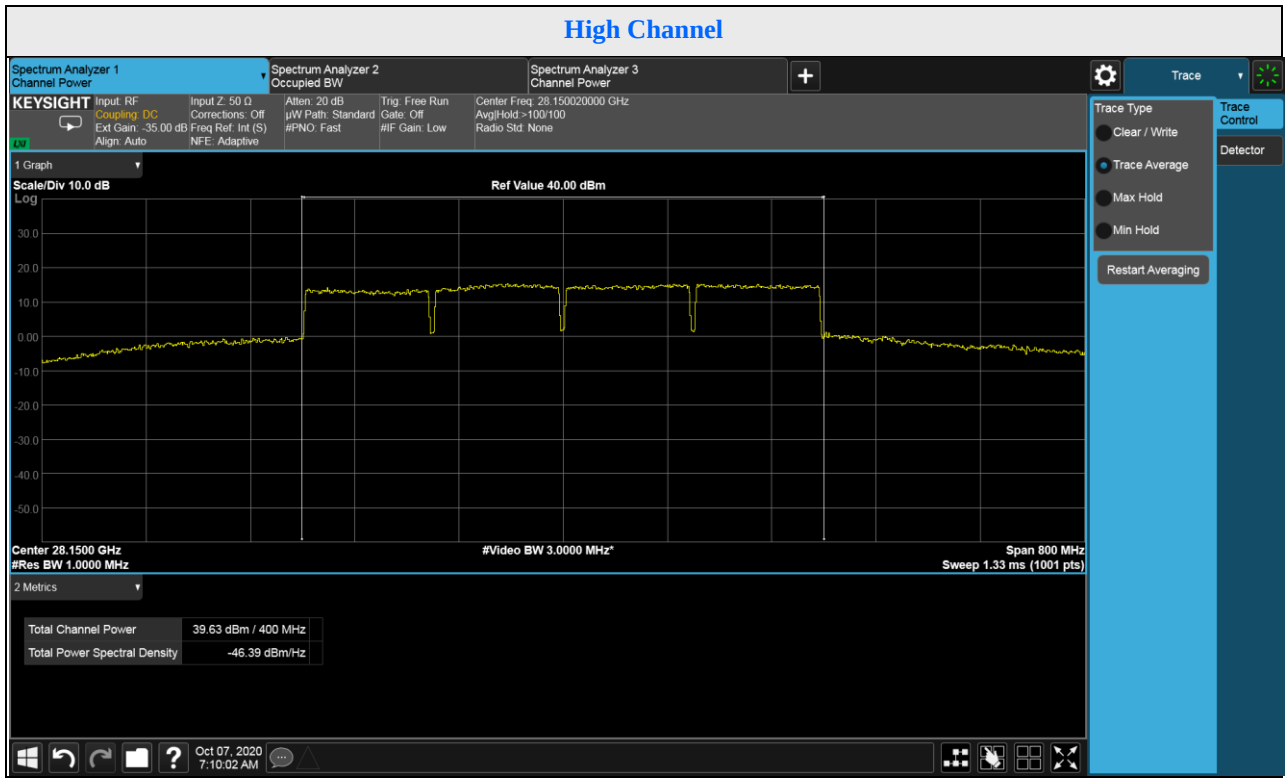


Middle Channel



High Channel



QPSK-4CC (Worse case plots)

Beam ID: 139

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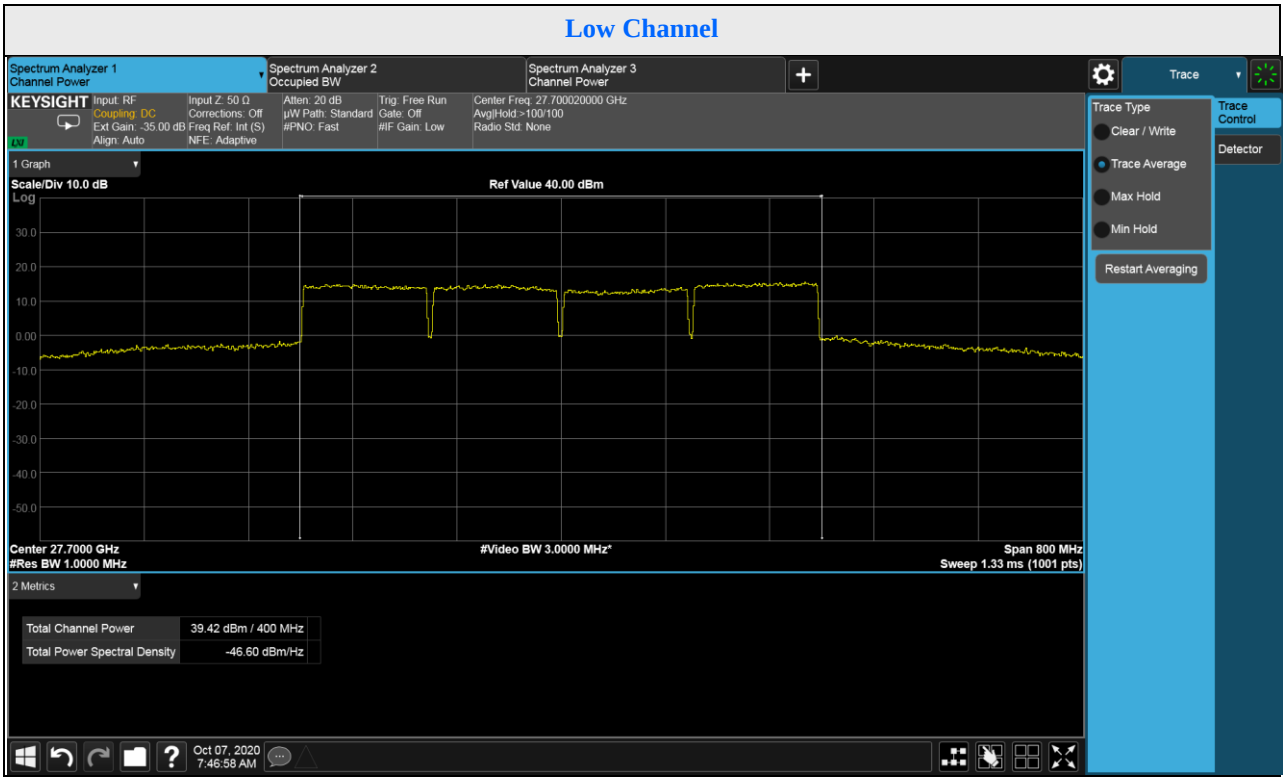

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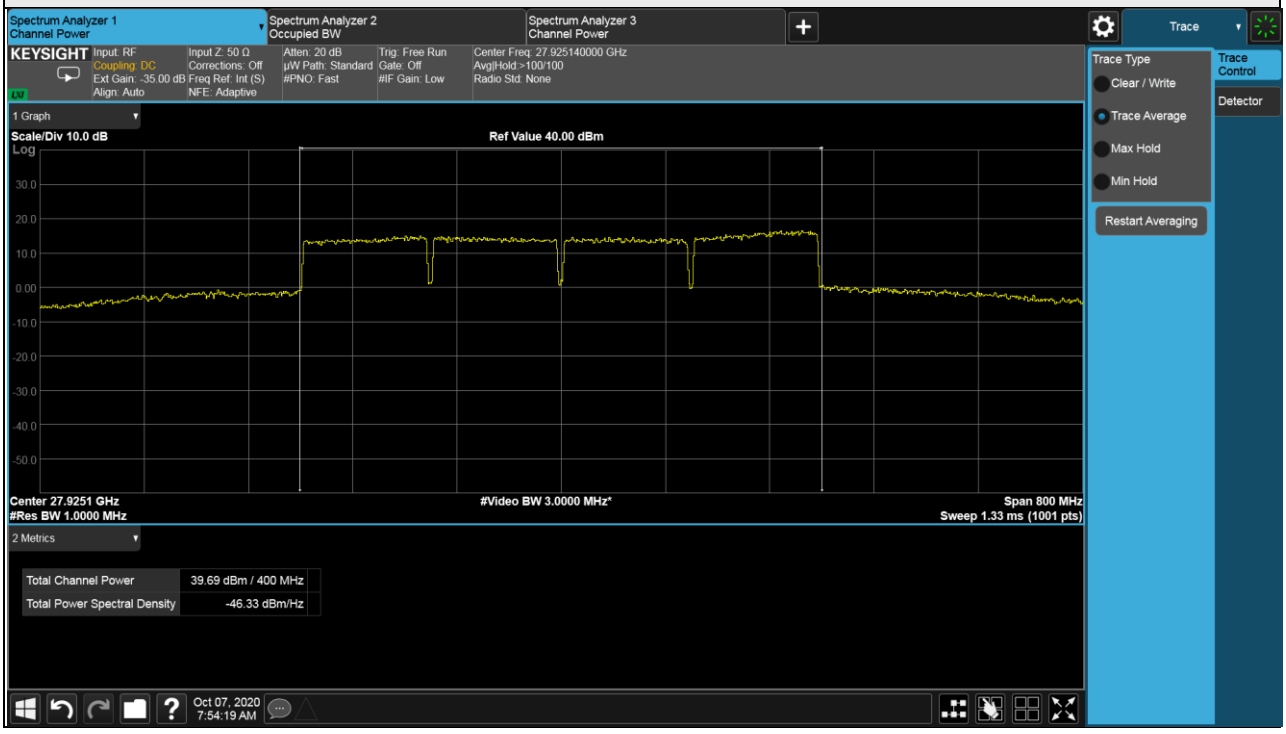

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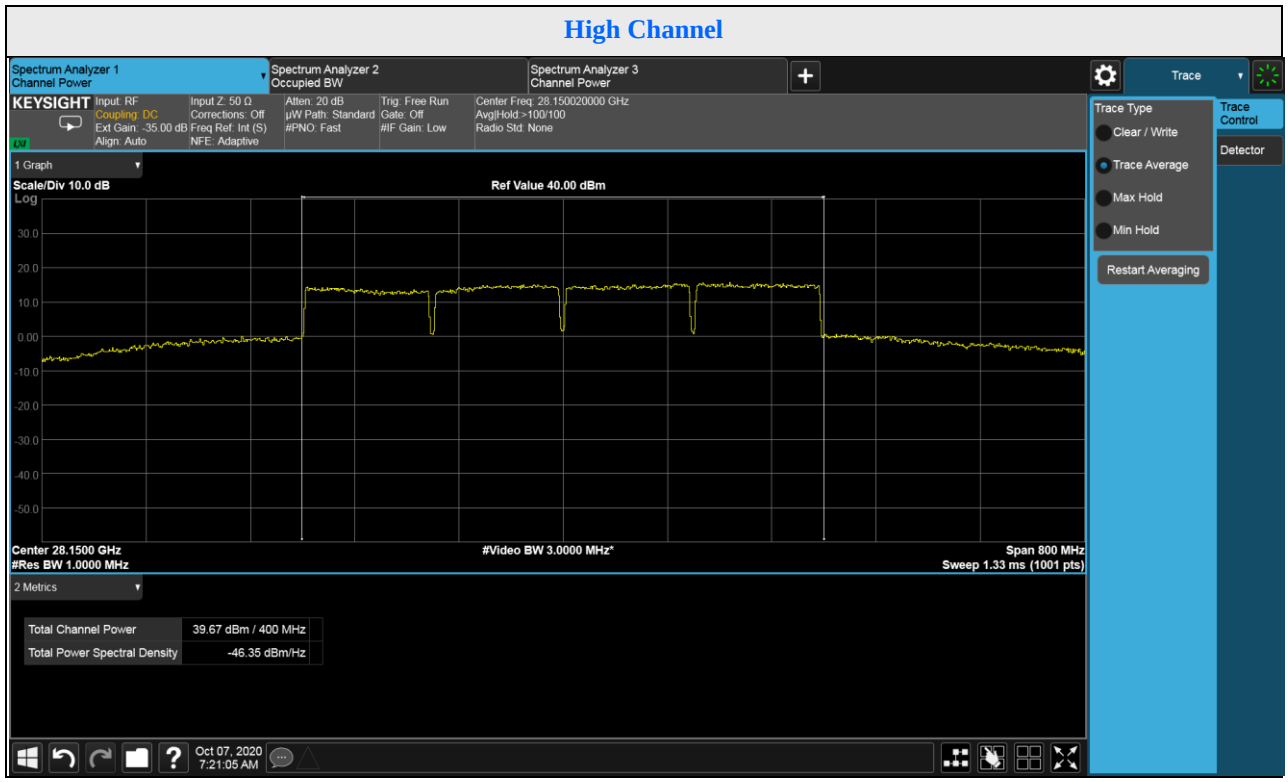
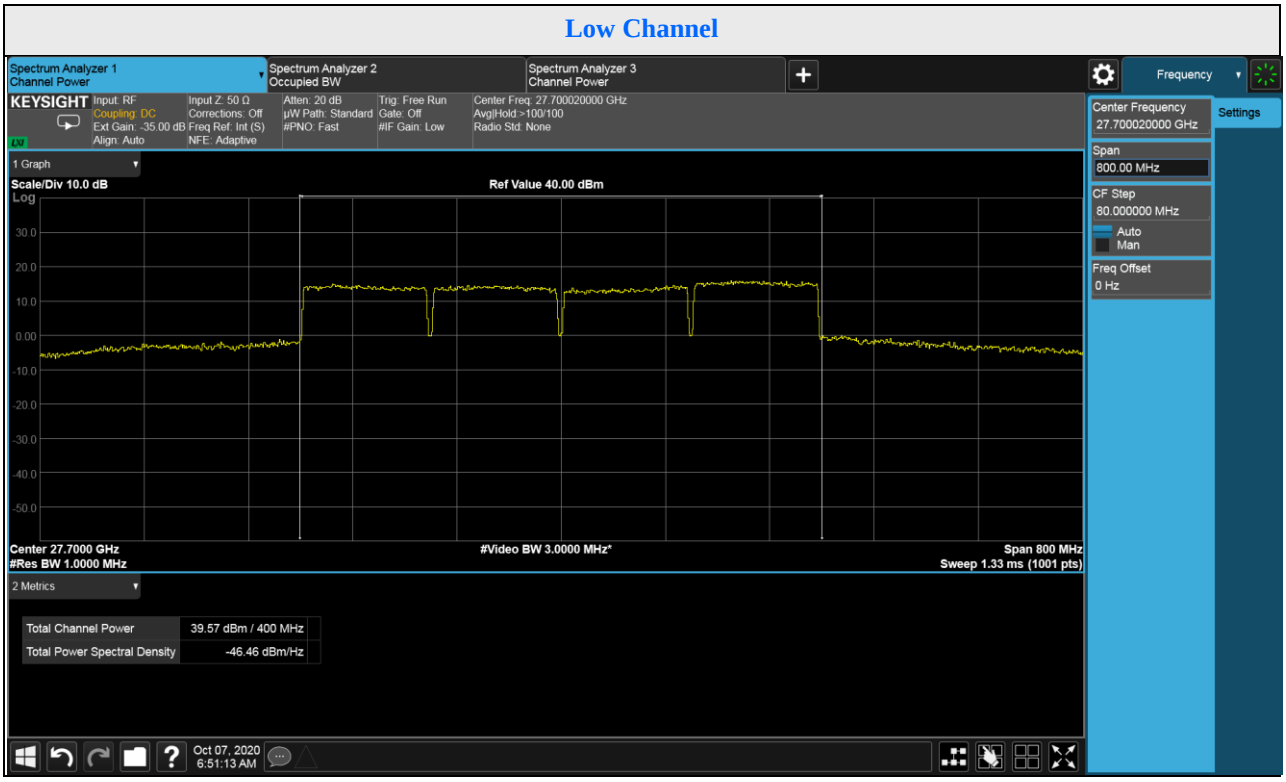


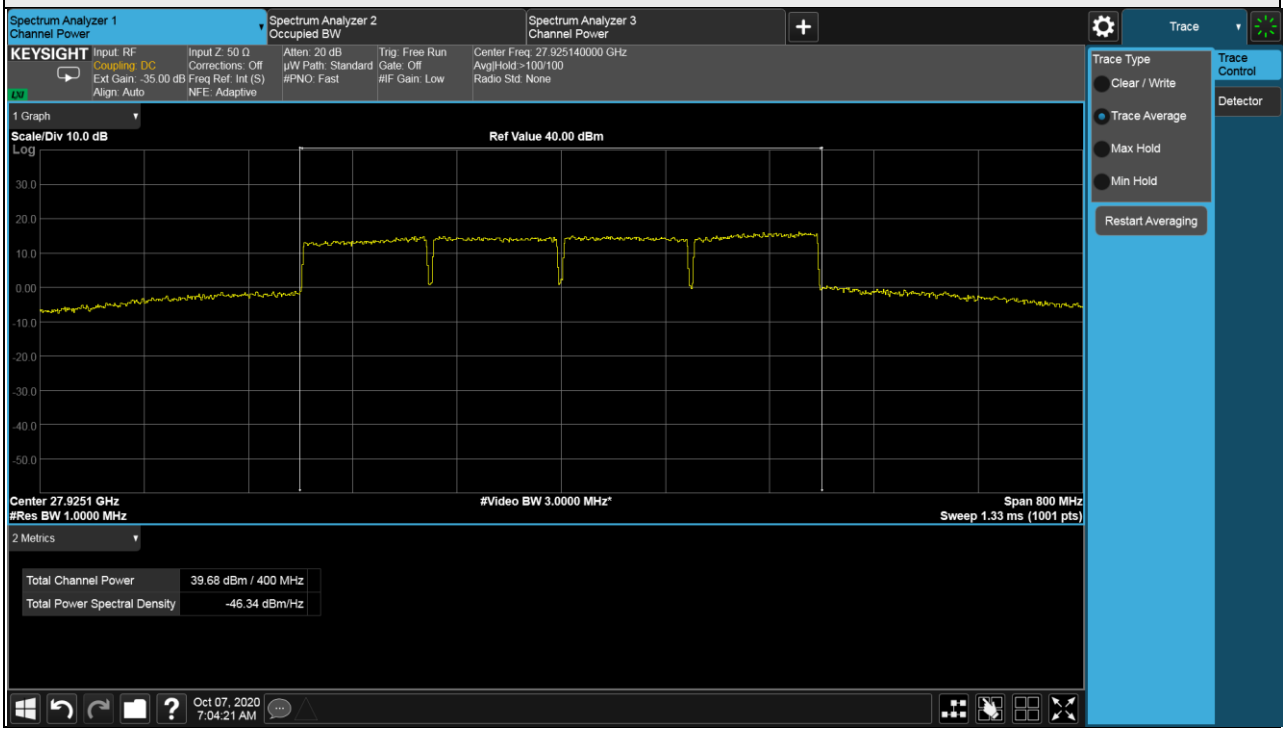
64QAM-4CC (Worse case plots)

Beam ID: 11

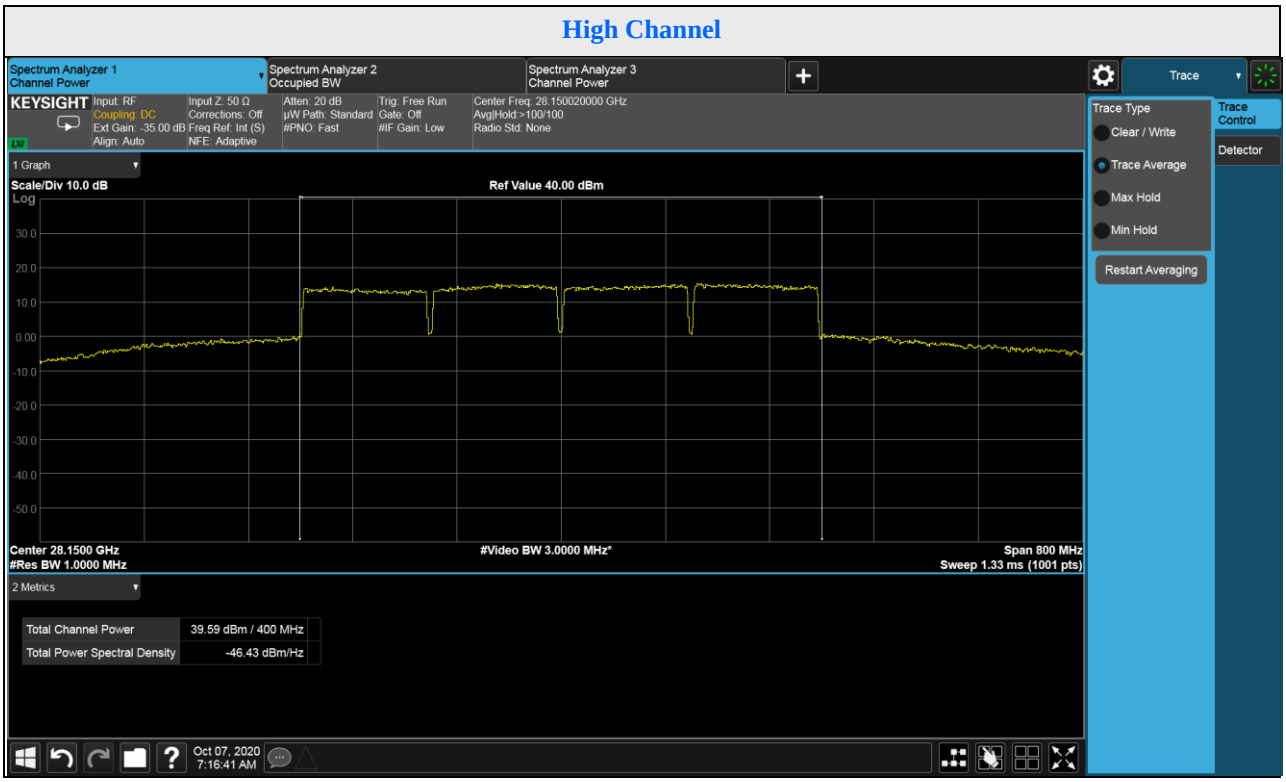
Low Channel



Middle Channel



High Channel



64QAM-4CC (Worse case plots)

Beam ID: 139

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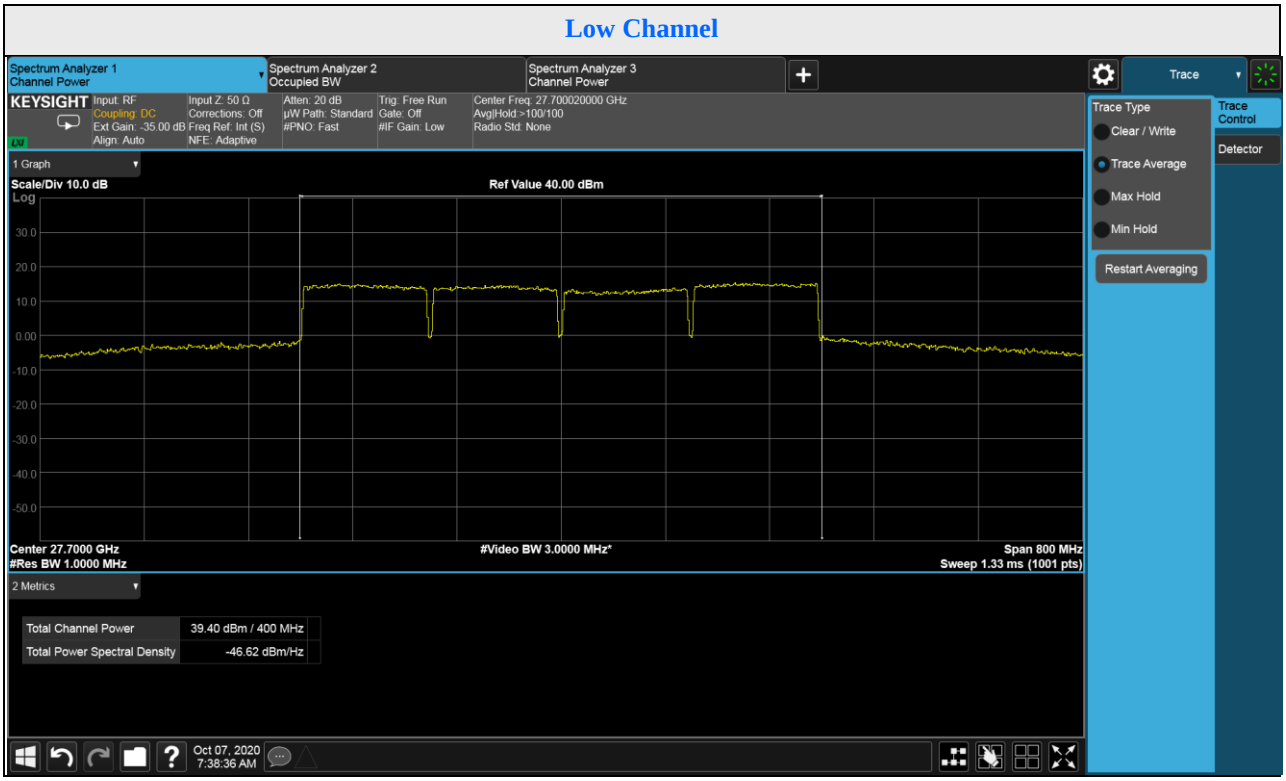

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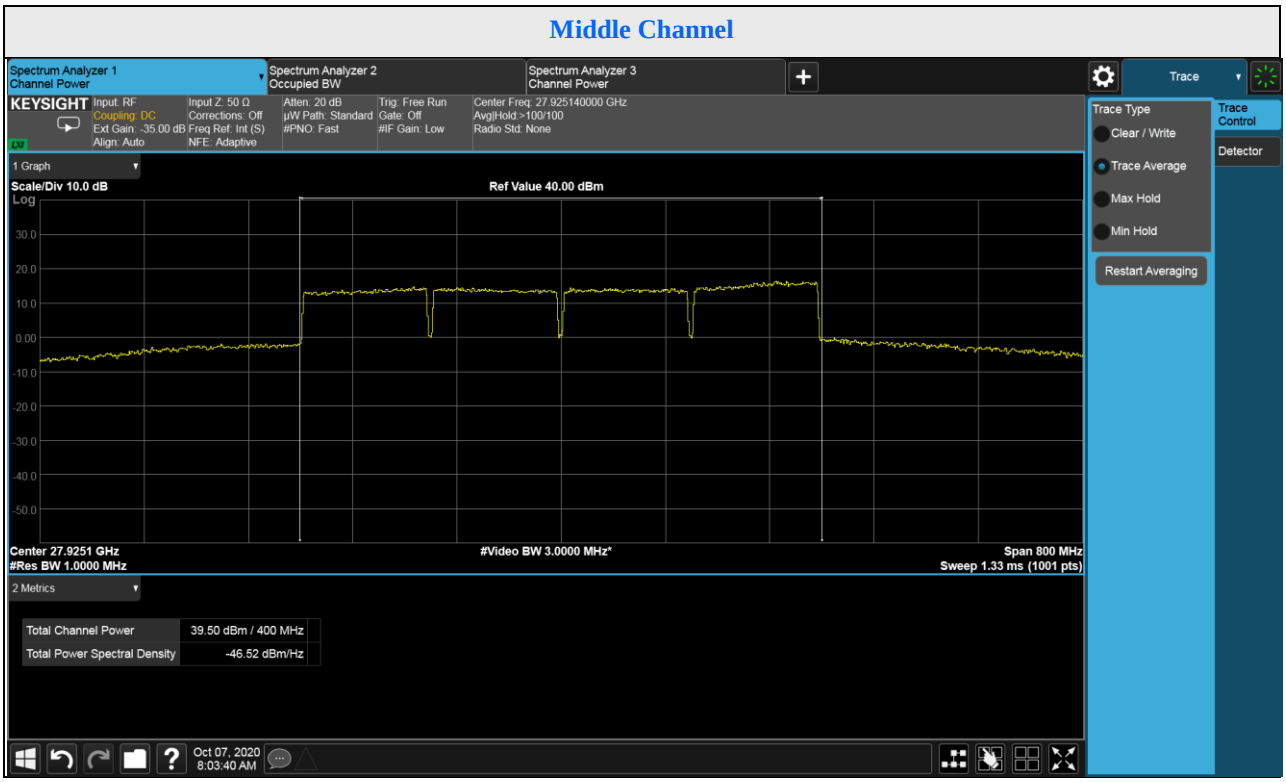
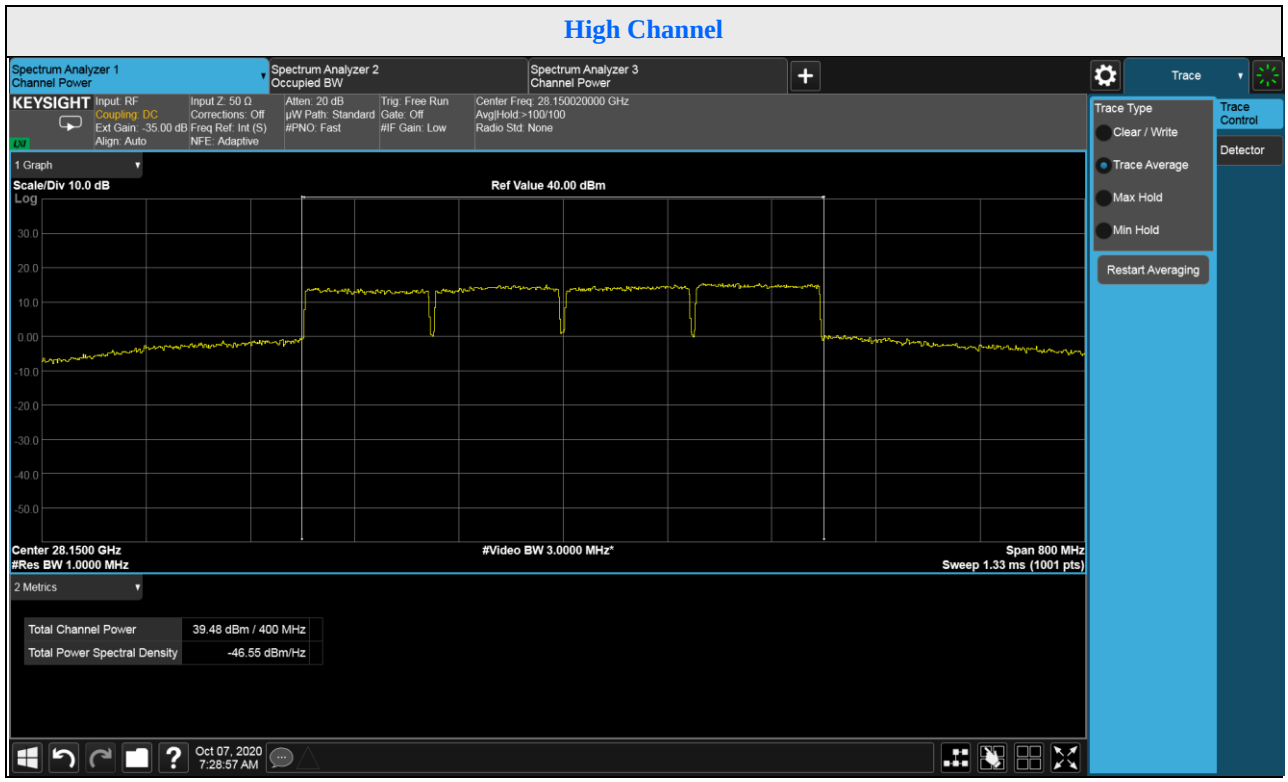


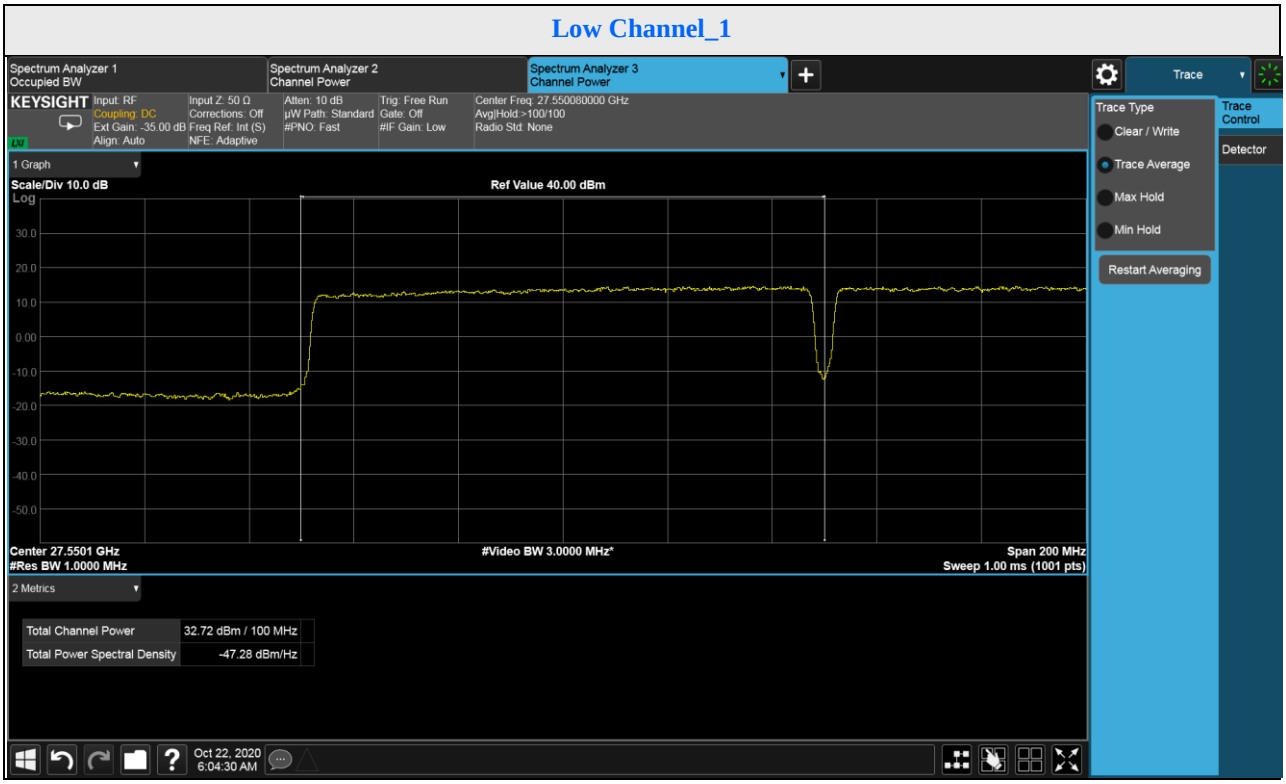
High Channel



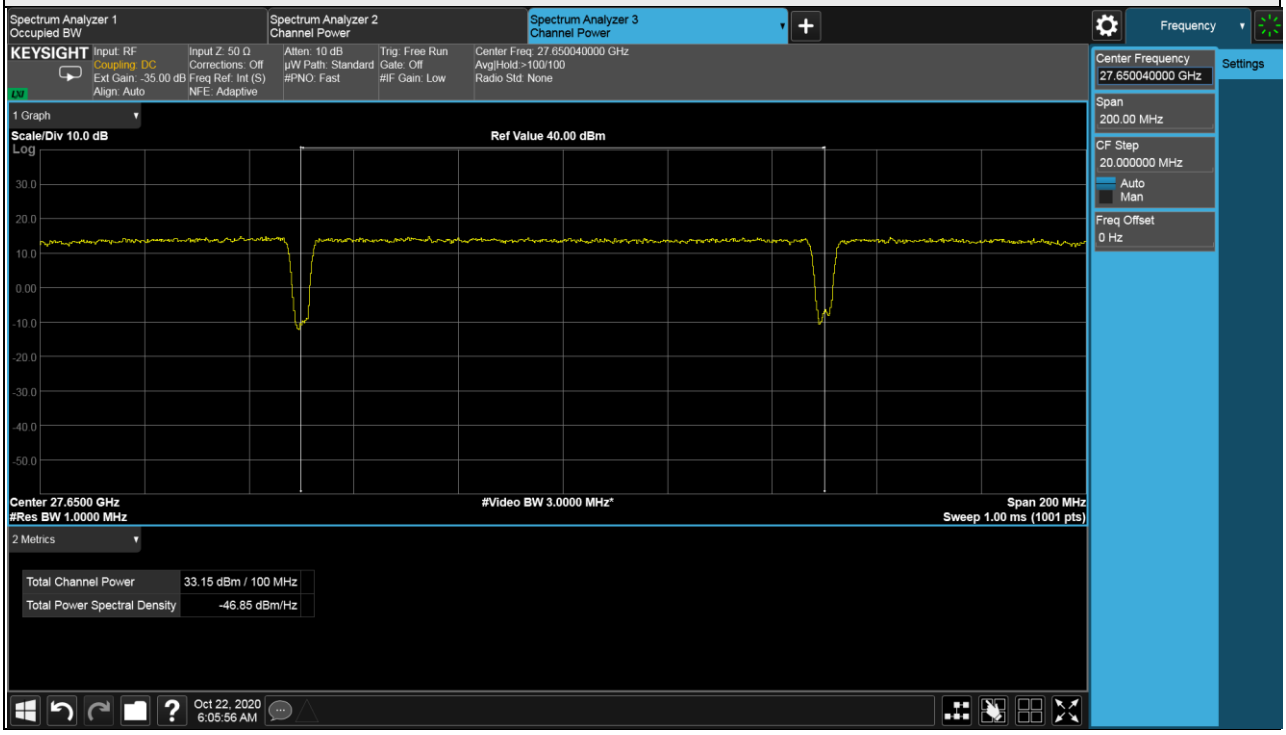
QPSK-4CC (Worse case plots)

Beam ID: 11

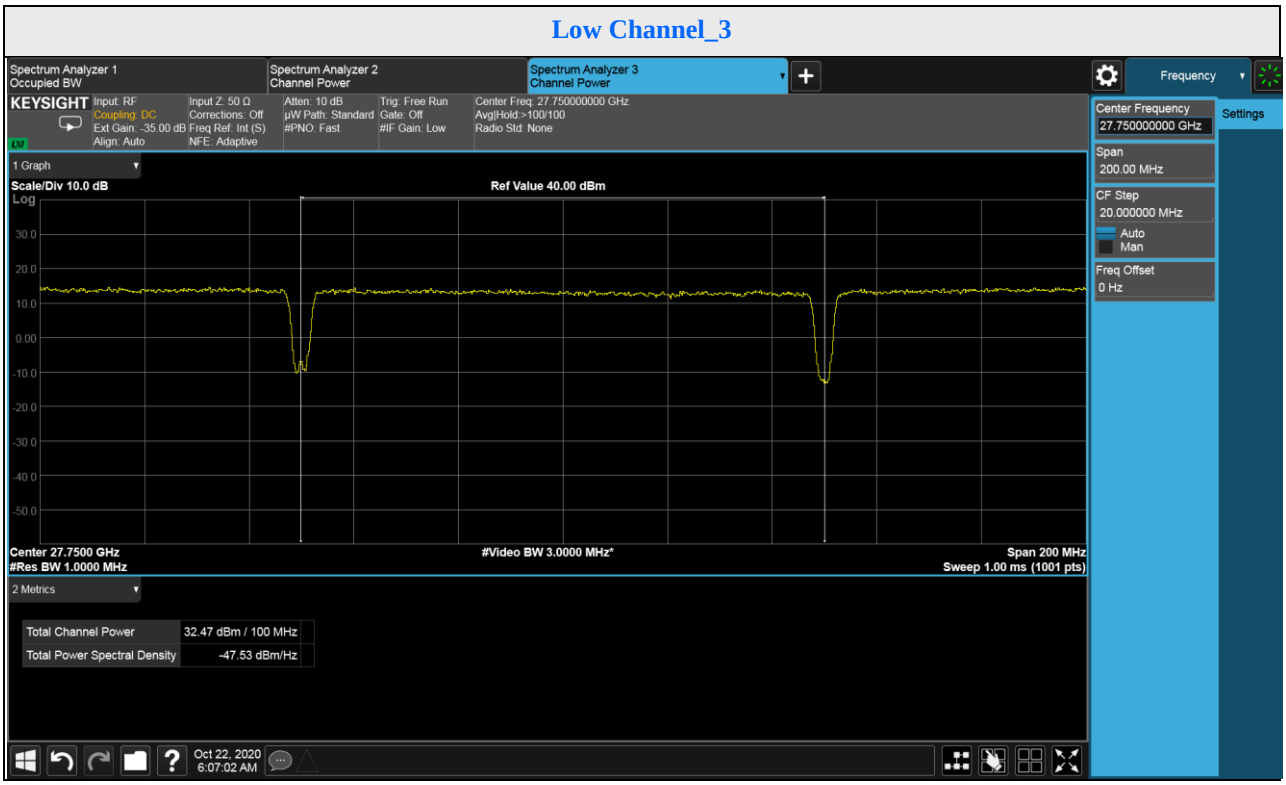
Low Channel_1



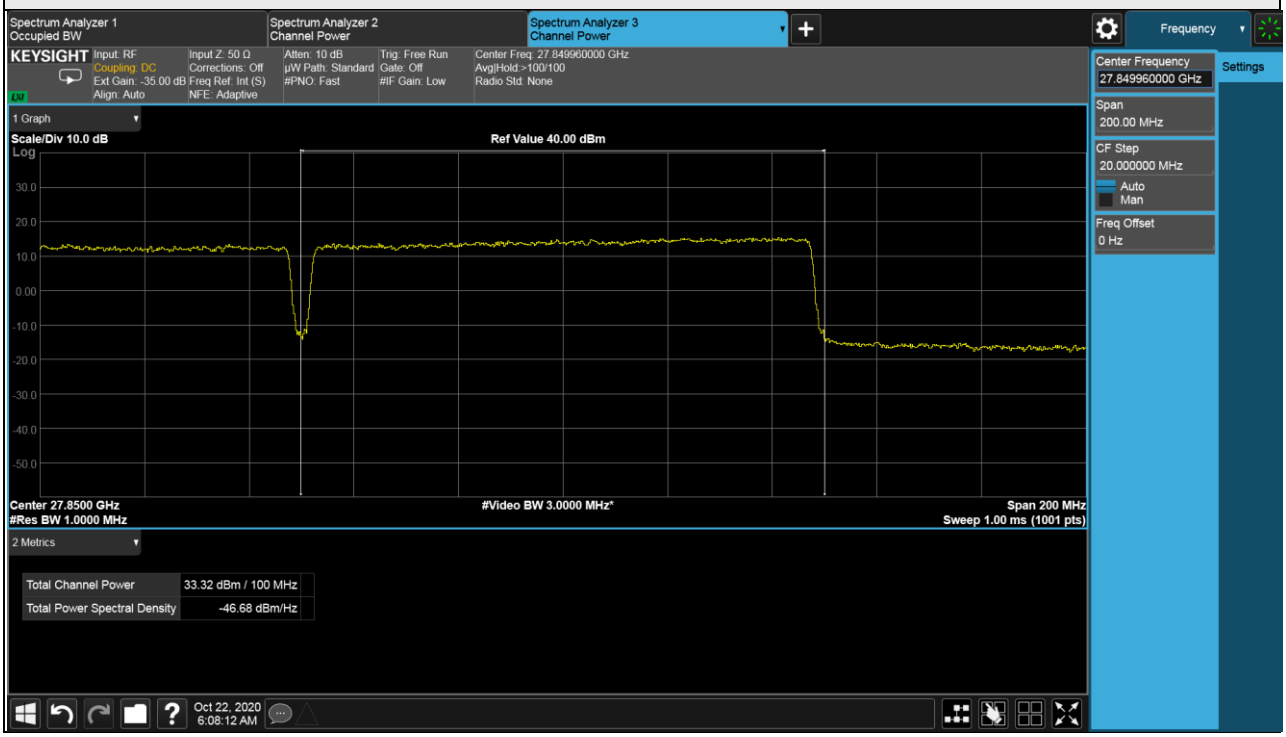
Low Channel_2



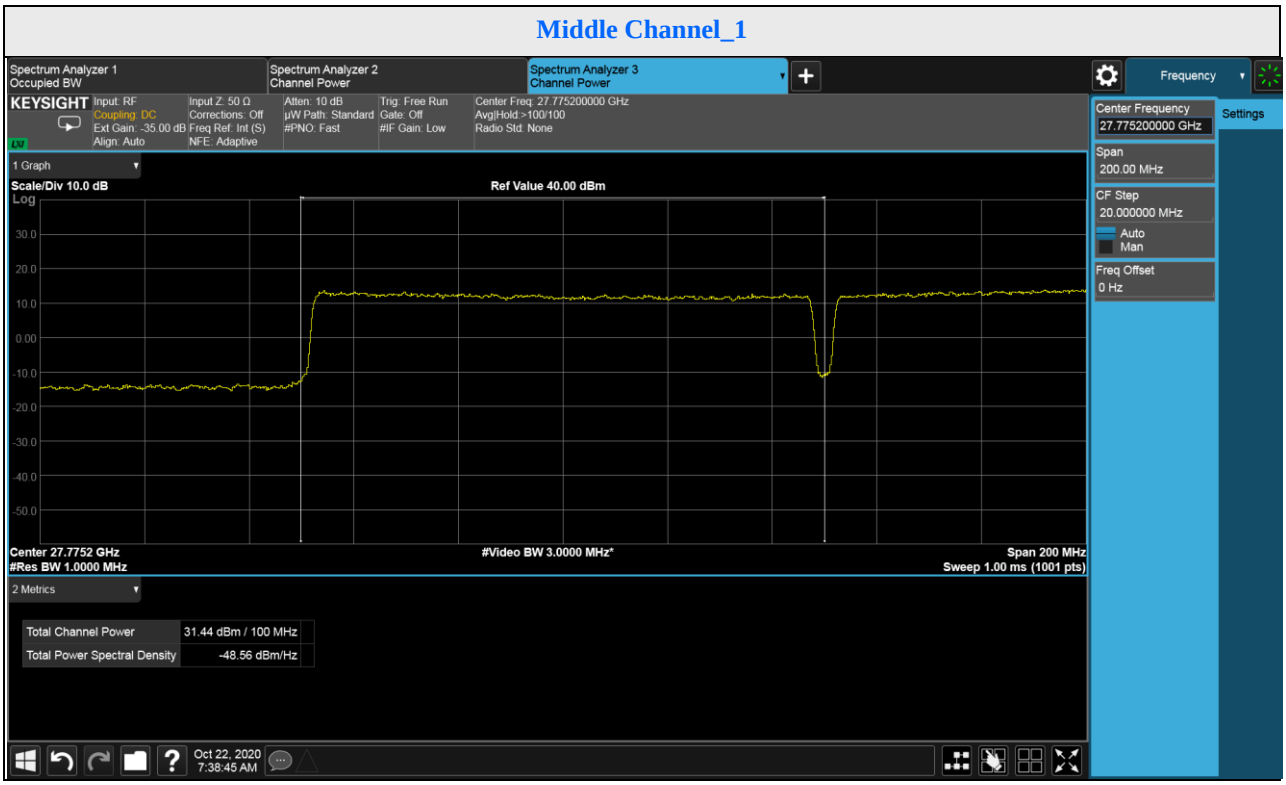
Low Channel_3



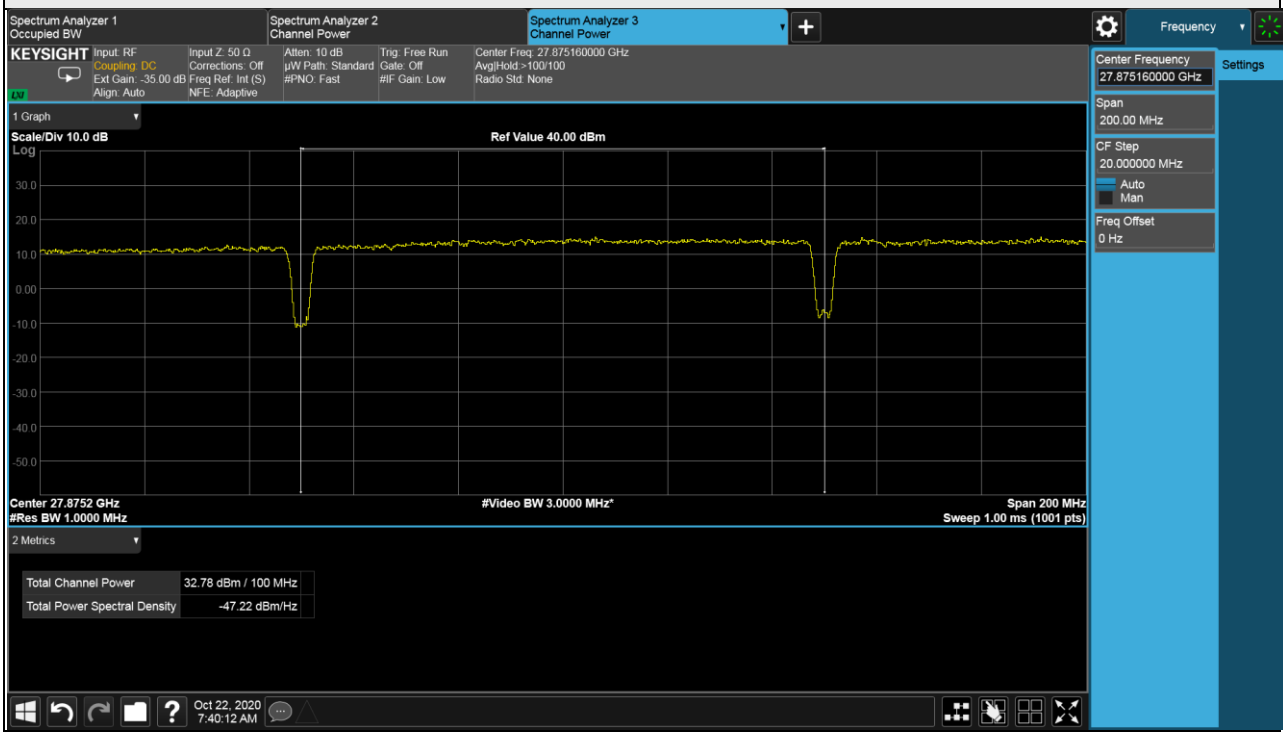
Low Channel_4



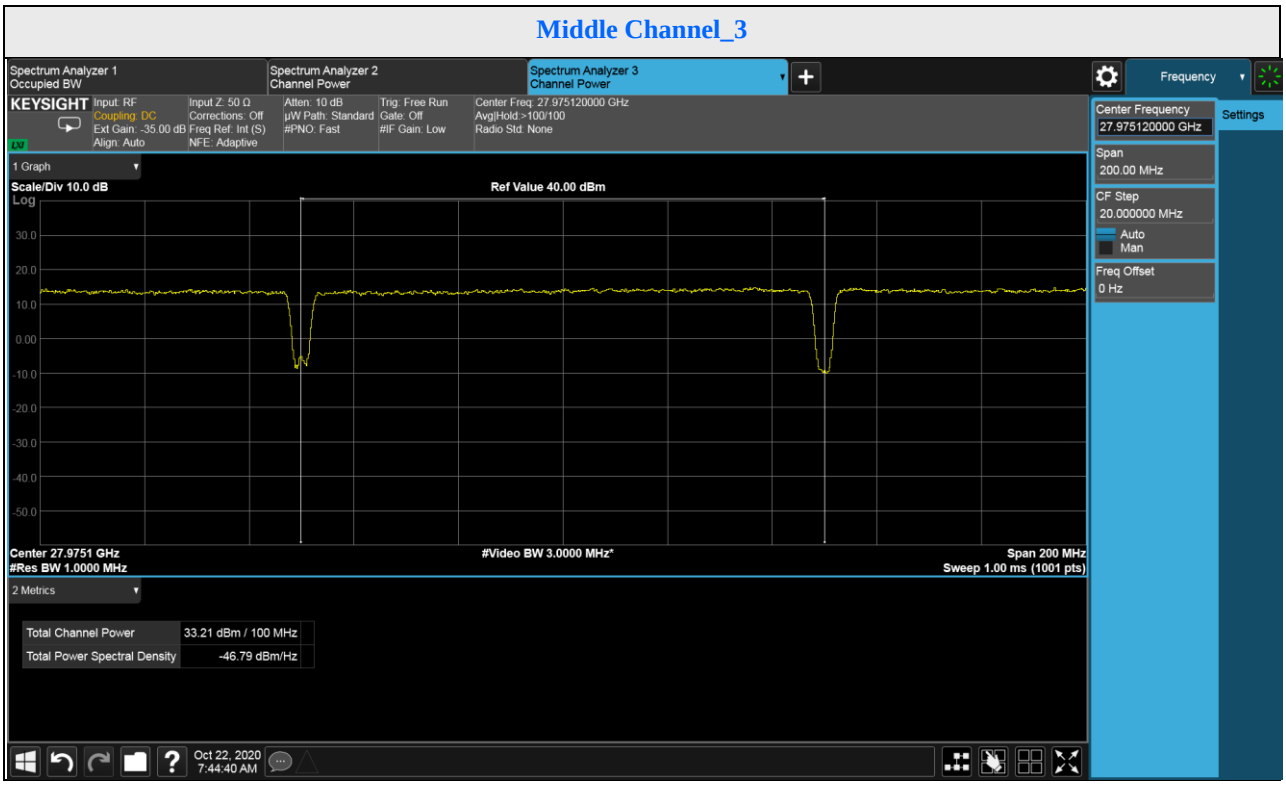
Middle Channel_1



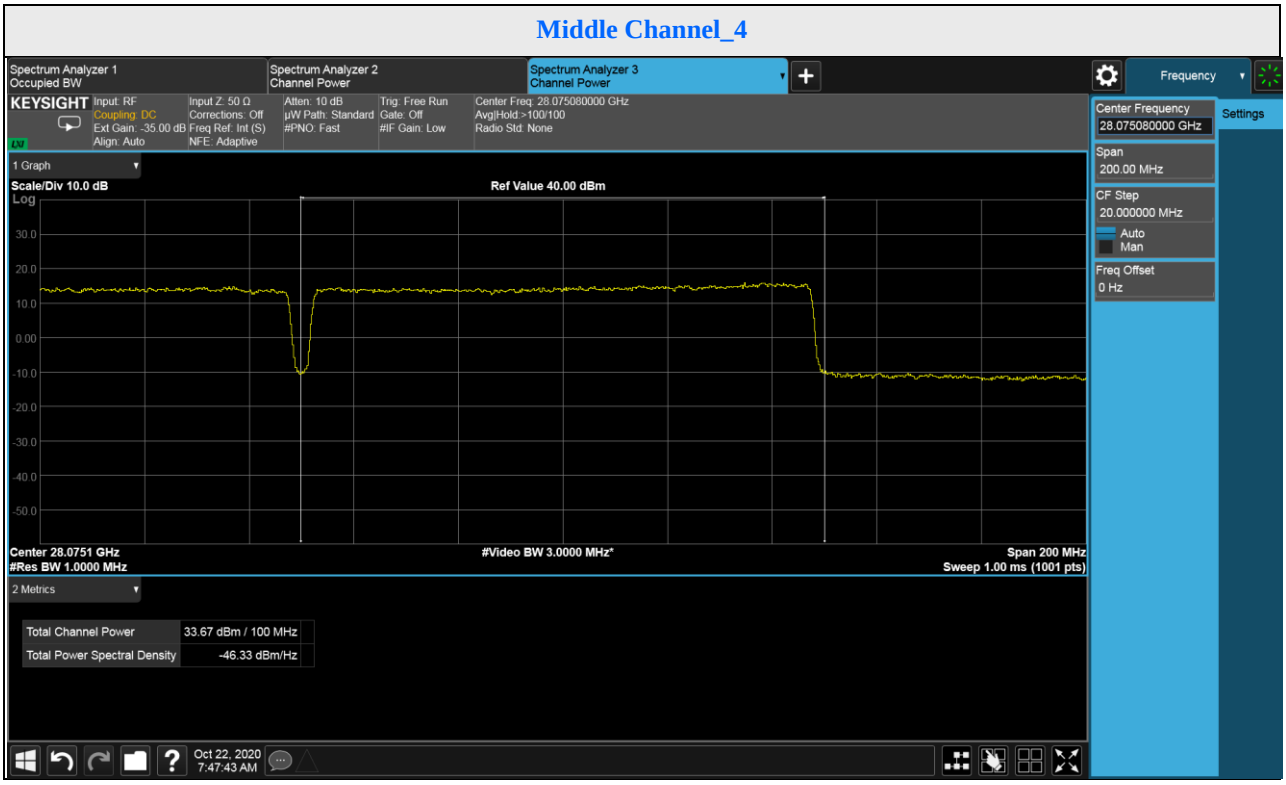
Middle Channel_2



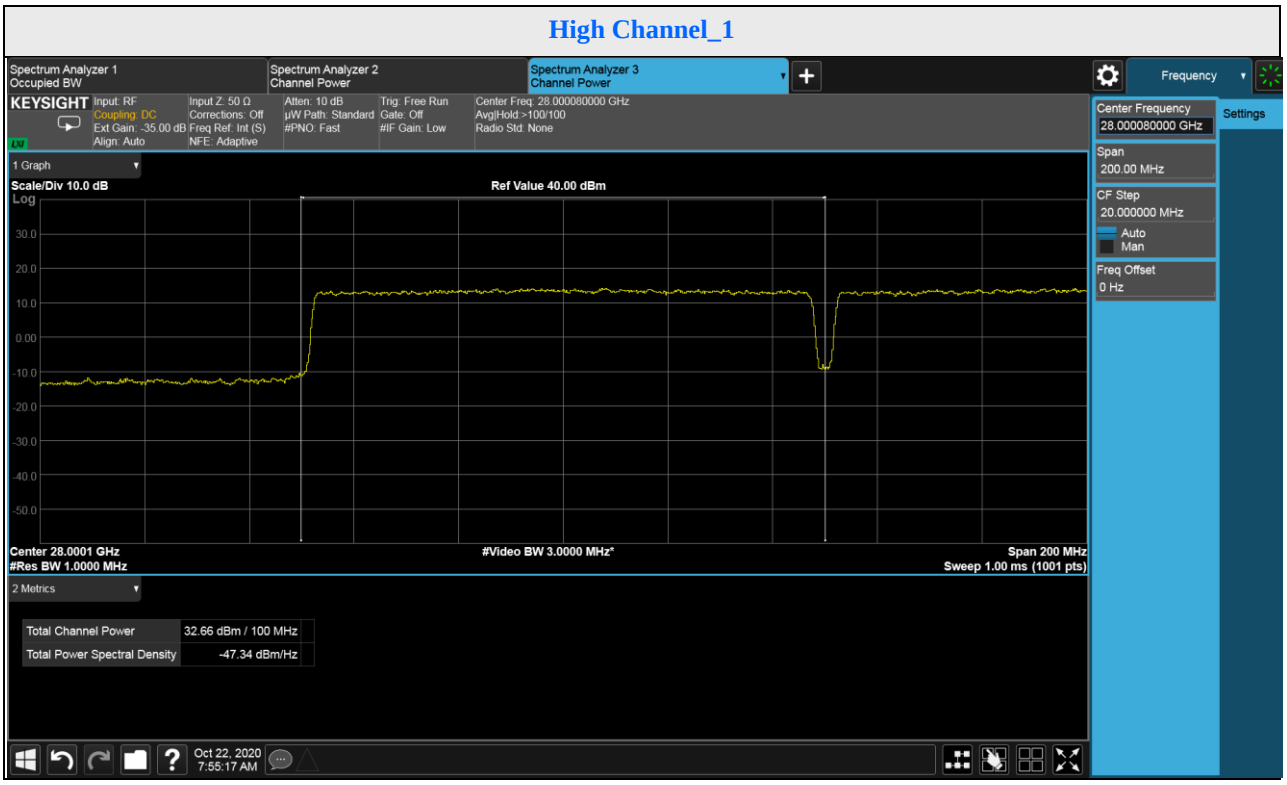
Middle Channel_3



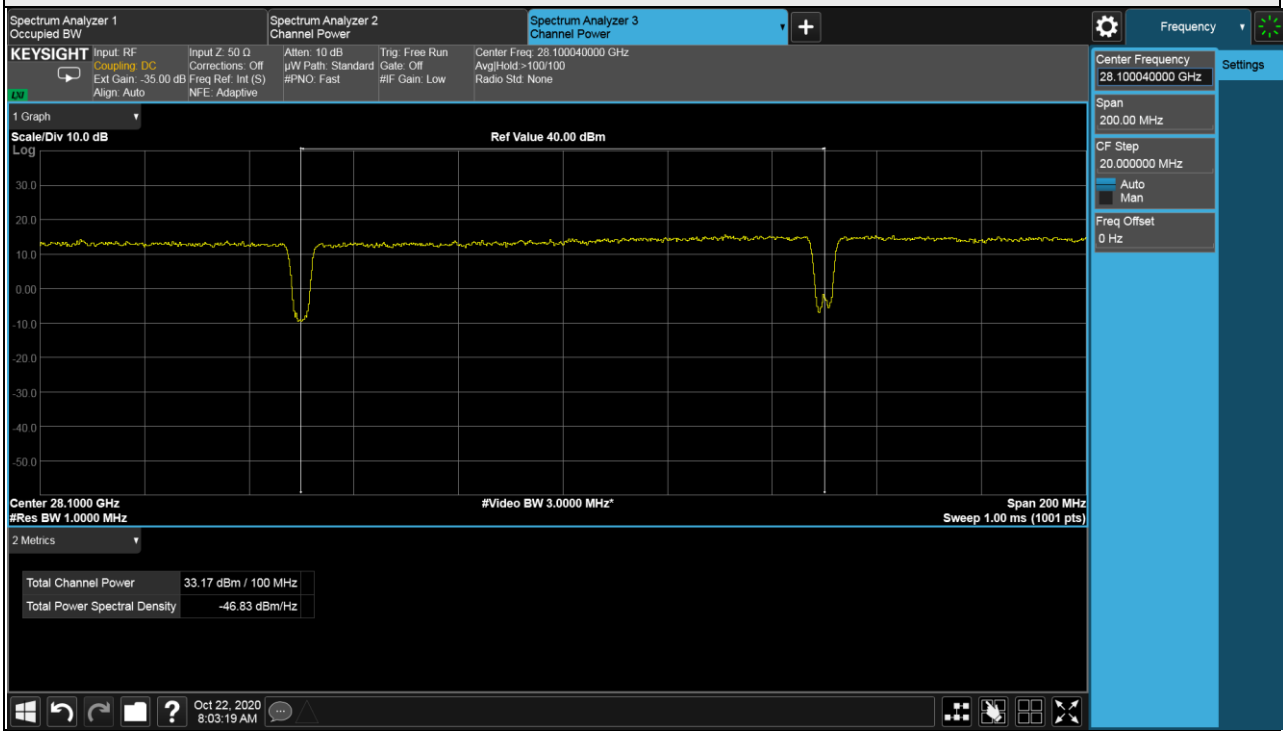
Middle Channel_4



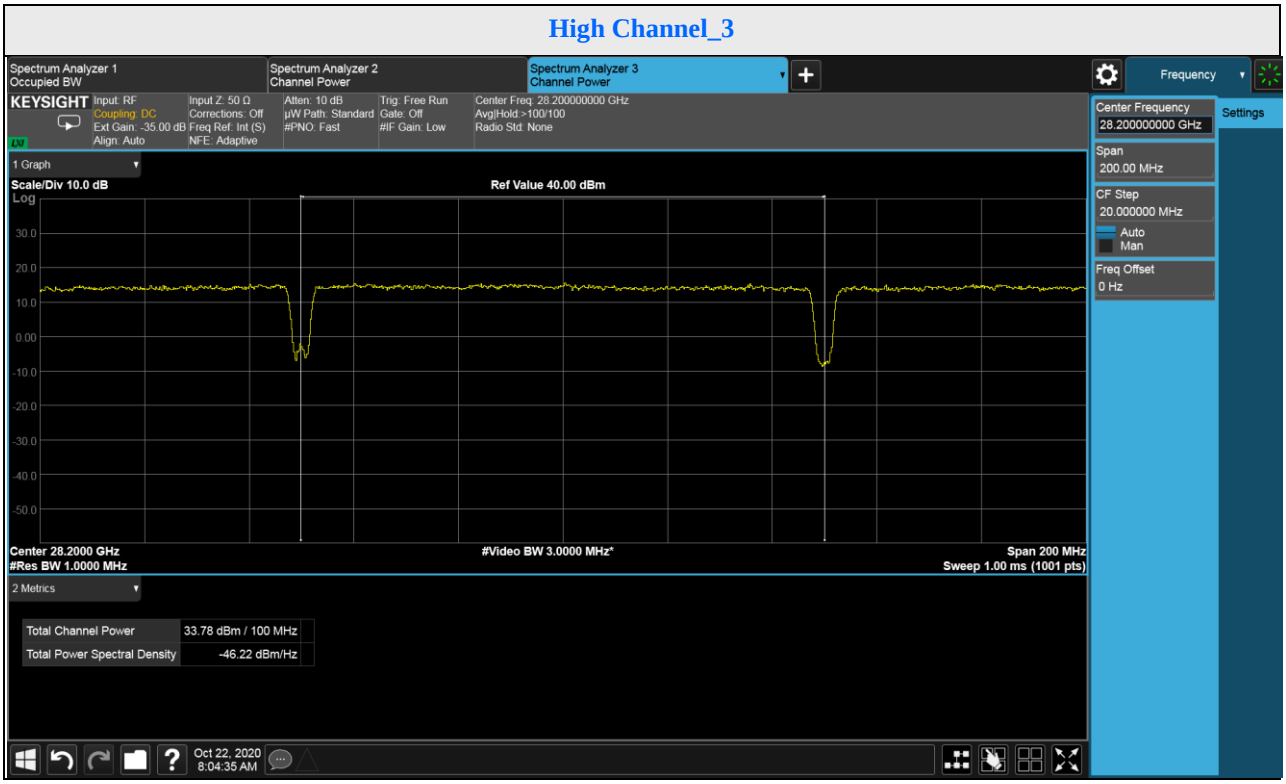
High Channel_1



High Channel_2



High Channel_3



High Channel_4